SECTION 4
MEASUREMENT OF RANGE AND BEARING

4.1 USE OF NAVIGATION TOOLS

The system is equipped with the navigation tools below.

Cursor

      Specifies an arbitrary point, and measures the range and bearing from the own ship.

Range Rings

      Displays concentric circles with own ship's position as the center at specified intervals, and the rings are used as rough guides for range measurement.

Electronic Bearing Line (EBL1/2)

      Displays a straight line for specifying an arbitrary bearing, and measures the bearing from the own ship.
      The process unit is equipped with two electronic bearing lines.

Variable Range Marker (VRM1/2)

      Displays a circle for specifying an arbitrary range, and measures the range from the own ship.
      The process unit is equipped with two variable range markers.

Parallel Index Line (PI)

      Displays straight lines at even intervals, and the lines are used as rough guides for complex measurement or ship courses.

EBL Maneuver

      Displays the course by steering the own ship, and it is used as a rough guide for ship maneuvering.

Man Overboard

      Stores the latitude and longitude where the own ship was at the point of storing the markers, and shows an anchor symbol on the radar display.　When the own ship has moved, the system displays the range and bearing to the position.
      Use this tool when the ship is anchored or man overboard.

EBL/VRM/PI Operation with Cursor (Cursor AUTO)

      Operates EBL, VRM, or PI on the radar display by using the cursor.
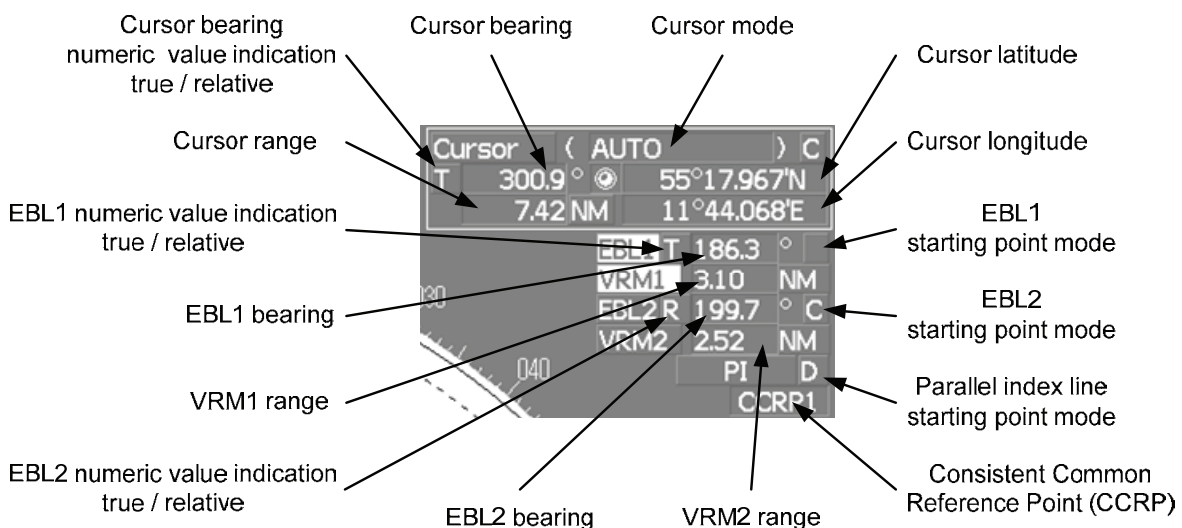
4.1.1 Using Cursor (Cursor)

Procedures   **1   Move the cursor onto the PPI display by moving the trackball.**

When the cursor is moved onto the PPI display, the arrow cursor turns into a cross cursor.

4.1.2 Using Range Rings [RR / HL]

Procedures   **1   Press the [RR / HL] key.**

The range ring display switches disappear and appear between display and non-display each time the [**RR / HL**] key is pressed.   The range ring interval is shown in the Range Rings display on / off (upper left of the display ② on page 2-16). The range between the target and own ship can be determined by visually measuring the target's position that lies between two range rings.
For change of the brilliance of range rings, refer to Section 3.8.5.

4

4.1.3 Using Electronic Bearing Line (EBL1/EBL2)

Electronic bearing lines (EBL) are indispensable to the measurement of bearings.
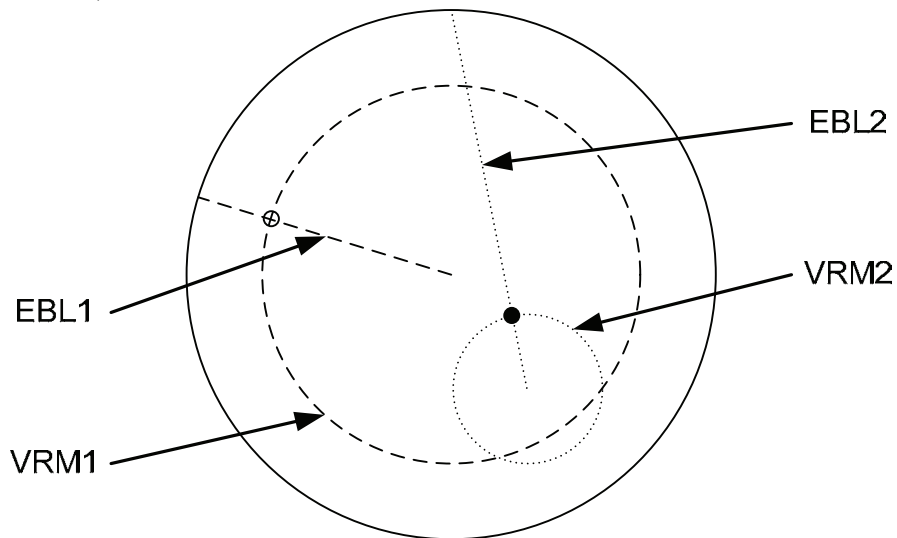Operators must be familiar with the operation of EBL beforehand.
The system is equipped with two EBL.   The bearing and starting point of an EBL can be operated separately from the other EBL.
An intersection marker is displayed at the intersection point of the EBL and VRM of the same number.

Intersection markers shown on EBL:
◯ : EBL1, VRM1
● : EBL2, VRM2

EBL Bearing Display

The bearing value of the current EBL1 or EBL2 on the PPI display is shown in the EBL1/2 bearing (upper right of the display on page 2-3).   The currently operable EBL1 or EBL2 is highlighted in the EBL1/2 adjustment (upper right of the display ⑤ /⑦ on page 2-19).

Starting Point of EBL

The starting point of the currently operating EBL can be switched from the center of the radar display to any offset position .   The offset position of the EBL starting point can be fixed on the radar display or at the latitude and longitude.   (The setting of the navigator is necessary for fixing the offset position at the latitude and longitude.)

[I]   Operating EBL (EBL)

To operate EBL

Procedures   **1   Press the [EBL1] or [EBL2] key.**

The EBL adjustment (upper right of the display ⑤/⑦ on page 2-19) will be highlighted, and the selected EBL becomes operable.

2   Turn the [EBL] dial.

To turn the **[EBL]** dial to the right, turn the EBL control clockwise, to turn the **[EBL]** dial to the left, turn the EBL control counterclockwise.

Cancellation   **1   Press the [EBL1] or [EBL2] key again.**

The selected EBL display will disappear.

[II]   Moving the Starting Point of EBL

The system provides three types of EBL starting points.   Select one of them in accordance with purpose.

       :The EBL starting point is defined as the own ship's position.

 C   :The EBL starting point is moved and fixed on the radar display.

 D   :The EBL starting point is moved and fixed at the latitude and longitude.
     (The navigator needs to be connected.)

To move the starting point of EBL

Procedures   **1   Make EBL1 or EBL2 operable.**

2   Press the [EBL] dial to set C or D for the EBL1 / EBL2 starting point mode switching (upper right of the display ⑪/⑫ on page 2-19).

The selected EBL starting point mode is switched as shown below each time the dial is pressed.

    ⇒ C ⇒ D ⇒

3   Put the cursor on the EBL starting point is to be moved, and press the [ENT] key.

The selected EBL starting point will be determined.

To return the EBL starting point to own ship's position

Procedures

1 **Make EBL1 or EBL2 operable.**

2 **Press the [EBL] dial to set ☐ for the EBL1 / EBL2 starting point mode switching (upper right of the display ⑪/⑫ on page 2-19).**

The selected EBL starting point will be set as the own ship's position.

[III] Setting EBL Operation Mode

To set the numeric value display mode of EBL (EBL Bearing REF)

Determine whether to display EBL in true bearing mode or relative bearing mode.

Procedures

1 **Put the cursor on the EBL1/2 numeric value indication true / relative switching (upper right of the display ⑨/⑩ on page 2-19), and press the [ENT] key.**

The selected mode is switched as shown below each time the **[ENT]** key is pressed.

$\boxed{T} \Rightarrow \boxed{R} \Rightarrow \boxed{T}$

$\boxed{T}$: EBL bearing is displayed in true bearing mode.
$\boxed{R}$: EBL bearing is displayed in relative bearing mode.

To set a mode for fixing EBL display (EBL Bearing Fix)

When this function is set to $\boxed{\text{Angle}}$, an EBL is fixed to the preset bearing. For example, if a true bearing of 020° is preset, the EBL is fixed to the true bearing 020° even when the own ship turns.

When the function is set to $\boxed{\text{Screen}}$, the EBL is fixed on the radar display. In this case, the EBL is always fixed to the same bearing on the display when the own ship turns.

Procedures

1 **Press the [RADAR MENU] key twice.**

2 **Open the EBL/Cursor Setting menu by performing the following menu operation.**

5. Sub Menu
      9. EBL/Cursor Setting

3 **Press [1] or [2] key.**

To set EBL1, press the **[1]** key, to set EBL2, press the **[2]** key

$\boxed{\text{Angle}}$: EBL bearing is fixed to the preset value.
$\boxed{\text{Screen}}$: EBL bearing is fixed on the radar display.

Note: Course data is necessary for turning on this function.

## 4.1.4 Using Variable Range Marker (VRM1 / VRM2)

Variable range markers (VRM) are indispensable to the measurement of ranges.   Operators must be familiar with the operation of VRM beforehand.
The system is equipped with two VRM.   The VRM can be operated separately from each other.
An intersection marker is displayed at the intersection point of the VRM and EBL of the same number.
When the starting point of an EBL is offset, the center of the VRM is defined as the offset EBL starting point.

Intersection markers shown on VRM:
 ○ : EBL1, VRM1
 ● : EBL2, VRM2
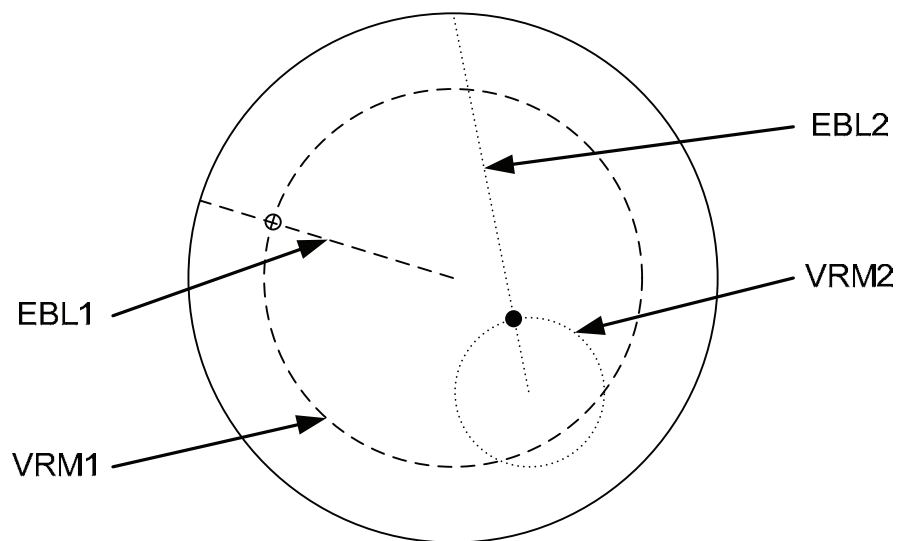
VRM Operation

The range value of the current VRM1 or VRM2 on the PPI display is shown in the VRM1/2 range (upper right of the display on page 2-3).   The currently operable VRM1 or VRM2 is highlighted in the VRM1/2 adjustment (upper right of the display ⑥/⑧ on page 2-19).

To operate VRM

Procedures   **1   Press the [VRM1] or [VRM2] key.**

The VRM adjustment (upper right of the display ⑥/⑧ on page 2-19) will be highlighted, and the selected VRM becomes operable.

2   Turn the [VRM] dial.

To turn the **[VRM]** dial to the right, the VRM control wide, to turn the **[VRM]** dial to the left, the VRM control narrow.

Cancellation   **1   Press the [VRM1] or [VRM2] key again.**

The selected EBL display will disappear.

4.1.5 Using Parallel Index Lines (PI Menu)

Parallel index lines can be displayed.

[I]   Operating Parallel Index Lines (PI)

Procedures   **1   Press the [VRM] dial.**

Parallel index lines and the PI Menu will appear.
To change the bearing of parallel index lines, turn the **[EBL]** dial, to change the line interval, turn the **[VRM]** dial.
The bearing and interval of parallel index lines are displayed in the PI Menu.

2   Press the [VRM] dial again.

The parallel index lines will be fixed.

Note: Parallel index lines are operable only while the PI Menu is displayed.   When the menu is closed, the parallel index line display remains, but the settings of the bearing and interval cannot be adjusted any more.   To adjust the bearing and interval after closing the menu, press the **[VRM]** dial twice to open the PI Menu.
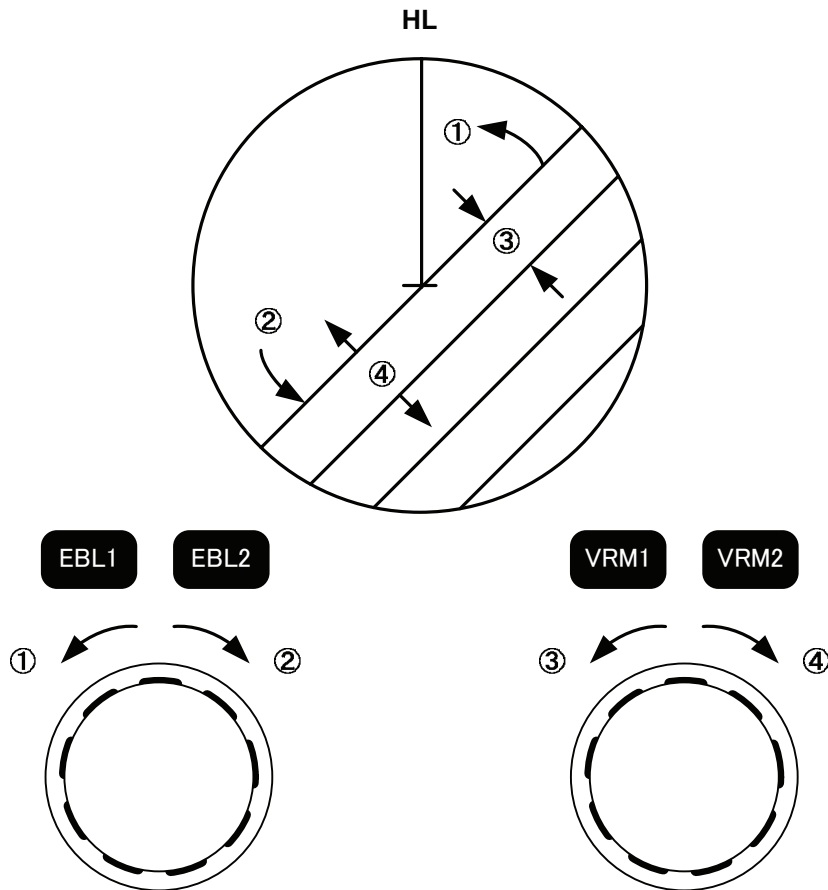
Cancellation   **1   Press the [VRM] dial again.**

The parallel index line display will disappear.

[II]   Operation of Parallel Index Lines

◎ Parallel index lines rotate in the same direction as you turn the **[EBL]** dial.   (① , ②)
◎ The intervals of parallel index lines narrow when you turn the **[VRM]** dial counterclockwise
     (③), and widen when you turn the **[VRM]** dial clockwise (④).

HL

◎ When the **[VRM]** dial is pressed, the PI Menu closes and the parallel index lines are fixed.

During the operation of parallel index lines, pressing the **[EBL1]** or **[EBL2]** key disables operation
for rotation directions.   Pressing the **[VRM1]** or **[VRM2]** key disables operation for parallel index
line intervals.

[III] Settings in PI Menu

The operation of parallel index lines can be set in the PI Menu.

`Procedures` **1 Open the PI Menu by performing the following menu operation.**

| Tool |

| 1. PI Menu |

[1] Display for All Lines

Sets the parallel index line display to on or off.

| On | :Parallel index lines are displayed.

| Off | :Parallel index lines are not displayed.

[2] Operation Mode

Sets an operation mode for parallel index lines.

| All | :All the parallel lines are operated at the same time.

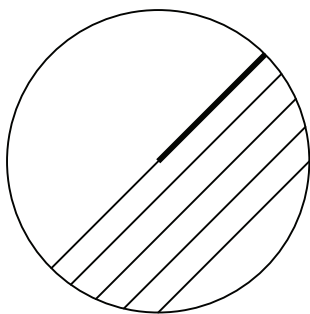| Individual | :The bearing of each line is operated individually.

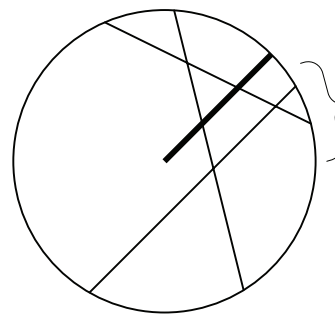| Track | :Equally spaced lateral lines are displayed on both sides.

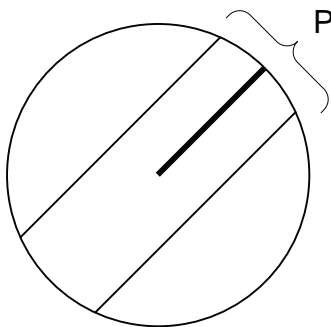| Equiangular | :Two lines intersecting at the center of a circle are displayed.
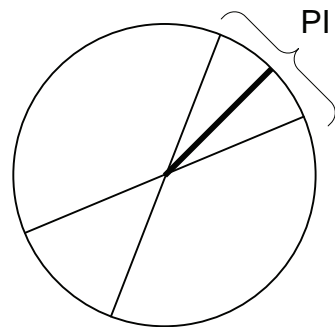

All

Individual

Track

Equiangular

Operation if ⬚Individual⬚ is selected

A line perpendicular to the own ship and the intersection marker "----○" are displayed on an operable line.
Turning the **[EBL]** dial changes the direction.
Pressing the **[VRM]** dial changes the range, end point 1, or end point 2 to be operated.
An operable point is displayed with " ● " and can be operated by turning the **[VRM]** dial.
If ⬚Sequential⬚ is selected for **[3] Control**, the parallel index lines of the next number can be displayed by pressing the **[EBL]** dial.
To close the menu, press **[0]** key.

Operation if ⬚Equiangular⬚ is selected

Select a group of lines to be operated according to the setting of **[3]** Control.
Pressing the **[EBL]** dial switches between the direction change mode and elevation-angle change mode.　Turning the **[EBL]** dial changes the direction or elevation angle.

4

[3]　Control

Determines whether to operate all the lines at the same time.　The setting items are determined by the setting of **[2] Operation Mode**.

If ⬚All⬚ is selected

The setting cannot be changed.
⬚All⬚ : All the lines are operated at the same time.

If ⬚Individual⬚ is selected

Determine whether to set consecutive lines or individual lines.
⬚Sequential⬚ : Lines are operated sequentially.
⬚Index Line1⬚ to ⬚Line8⬚ : A specified line is operated.

If ⬚Track⬚ or ⬚Equiangular⬚ is selected

Select a group of lines to be operated.
⬚Group1⬚ to ⬚Group4⬚ : A specified group is operated.

[4]　Floating

Moves the center point of parallel index lines.
⬚Off⬚ : The starting point of parallel index lines is defined as the own ship's position.
⬚Screen Fix⬚ : The center of parallel index lines is moved and fixed on the radar display.
⬚L/L Fix⬚ : The center of parallel index lines is moved and fixed at the latitude and :longitude.　(The navigator needs to be connected.)

[5]　Heading Link

Determines whether to operate parallel index lines following the heading bearing.
⬚On⬚ : Parallel index lines are operated following the heading bearing.
⬚Off⬚ : Parallel index lines are not operated following the heading bearing.

[6]   Next

Moves to the next page.

[1]   Range Scale Link

Determines the operation of parallel index line intervals when the range is changed.

| On | : The intervals are fixed with the actual range (nm).
The appearance of parallel index line intervals changes when the range is changed. |

| Off | : The intervals are fixed with the display range.
The parallel index line intervals (nm) change when the range is changed. |

[2]   Reference Bearing

Sets a reference bearing for the numeric data display of parallel index lines.   The setting items are determined by the setting of **[2] Operation Mode**.

If   All   is selected

| True | : Displayed with true bearing (with North as reference). |
| HL | : Displayed with the heading line as reference. |

If   Individual   is selected

True	: Displayed with true bearing (with North as reference).
HL	: Displayed with the heading line as reference.
Index Line1 to Line8	: Displayed with a specified line as reference.

If   Track   is selected

True	: Displayed with true bearing (with North as reference).
HL	: Displayed with the heading line as reference.
Index Line1 to Line8	: Displayed with a specified line as reference. Line1 , Line3 , Line5 , and Line7 correspond to Group1 , Group2 , Group3 , and Group4 , respectively.

If   Equiangular   is selected

The setting cannot be changed.

[3]   Operation Area

If   All   is selected for **[2] Operation Mode**, this function sets an area for displaying parallel index lines.

| One Side | : Parallel index lines are displayed only on one side. |
| Both Sides | : Parallel index lines are displayed on both sides. |

4-11

[4]   Display for Individual Line

Determines whether to turn on / off the parallel index line display of a selected number.

> On   : The line of the selected number is displayed.
>
> Off   : The line of the selected number is not displayed.
>
> If   All   is selected for **[2] Operation Mode**, the line near the own ship is line1.
>
> If   Track   or   Equiangular   is selected for **[2] Operation Mode**,   Line1 ,   Line3 ,
> Line5 , and   Line7   correspond to   Group1 ,   Group2 ,   Group3 , and   Group4 ,
> respectively.

4.1.6 Operating EBL Maneuver Function (EBL Maneuver Setting)

4

[I]   Initial Setting (EBL Maneuver Setting)

Procedures   **1   Open the EBL Maneuver Setting menu by performing the following menu operation.**

>   Tool
>
>   3. EBL Maneuver Setting

2   Set the following parameters.

>   Reach   : Set the range from when the rudder is steered to when the ship beings to turn.
>
>   Turn Mode   : Select a turn mode.
>
> >   Radius   :Turning radius (nm)
> >
> >   Rate   :Rate of turn (deg/min)
>
>   Turn Set   : Select the setting for turning.
>
> > If   Radius   is selected : Turning radius (nm)
> >
> > If   Rate   is selected   : Rate of turn (deg/min)

For inputs to the numeric value input menu, refer to Section 3.3.4.

Note: A wrong initial setting affects the maneuver curve function explained below.

[II] Creation of Maneuver Curve (EBL Maneuver)

1   Press the [1] key while the EBL Maneuver Setting menu is open.

The EBL maneuver function will be set to on or off.
A auxiliary line for maneuver curve creation, a maneuver curve, and a WOL will appear on the radar display.

2   Put the cursor on the starting point of the auxiliary line, and set the bearing of the auxiliary line by operating the [EBL] dial.

The bearing of the auxiliary line is the final bearing in which the own ship is to move.
The WOL position varies depending on the bearing of the auxiliary line.
If the WOL is behind the own ship's position, the line color of WOL will change.

3   Press the [ENT] key.

The setting will be determined.   However, if the WOL is behind the own ship's position at this point, pressing of the **[ENT]** key is rejected, and the setting is not determined.

4-13
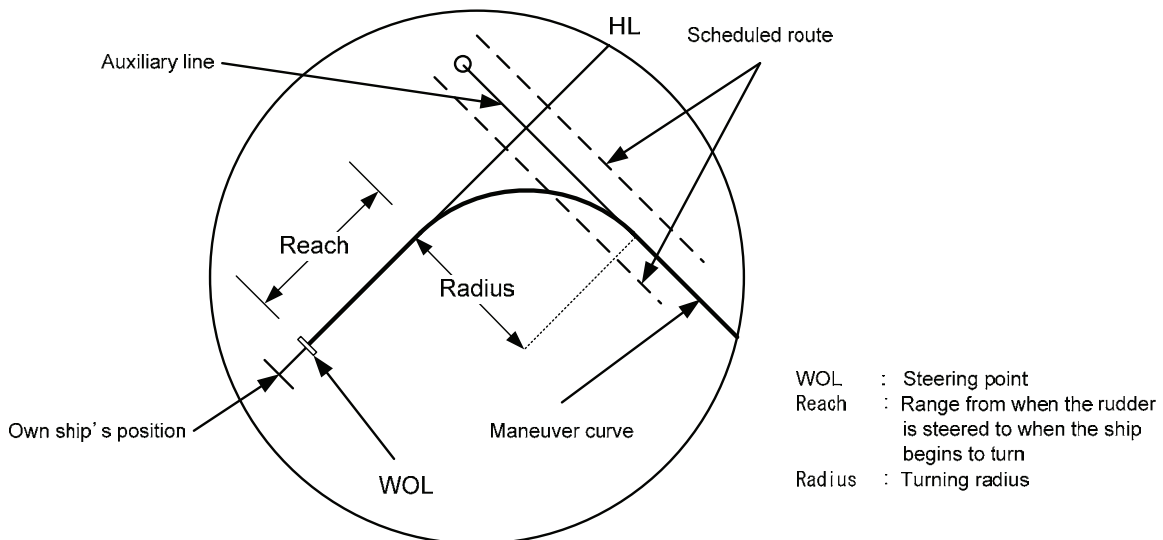
4.1.7 Using MOB [MOB]

The marker (anchor symbol) function displays a dotted line from the marker input position to the own ship's position, and indicates the range, bearing, and required time from the own ship's position to the marker.   (The navigator needs to be connected.)
For example, the function can be used for following purposes:
>   To confirm the drifting distance from where the ship was anchored.
>   To record a position of man overboard.

Procedures   **1   Press the [MOB] key.**

A marker will be displayed at the own ship's position on the radar display at the moment when the **[MOB]** key is pressed.   The own ship and the marker are connected with a dotted line.
Even when the own ship moves, the marker is fixed at the latitude and longitude. Thus, if a marker is put to an important position, the ship can return to the position regarding the marker as a target.

4

Cancellation   **1   Press the [MOB] key for 2 seconds.**

The marker will disappear.

4.1.8 Operating EBL, VRM, and PI with Cursor

When the cursor mode is set to AUTO (upper right of the display on page 2-3), EBL, VRM, and PI can be operated simply by using the trackball and the **[ENT]** key.

[I]   Operating Electronic Bearing Line (EBL)

Procedures   **1   Put the cursor on EBL1 or EBL2, and press the [ENT] key.**

When the cursor is moved to it, EBL1 or EBL2 is shown at the upper right of the cursor.   The EBL becomes operable when the **[ENT]** key is pressed.

2   Move the cursor to the bearing to be set.

The EBL will move as the cursor moves.

3   Press the [ENT] key.

The EBL will be fixed.

[II]   Operating Variable Range Marker (VRM)

Procedures

1   Put the cursor on VRM1 or VRM2, and press the [ENT] key.

When the cursor is moved to it, VRM1 or VRM2 is shown at the upper right of the cursor.   The VRM becomes operable when the **[ENT]** key is pressed.

2   Move the cursor to the range to be set.

The VRM will move as the cursor moves.

3   Press the [ENT] key.

The VRM will be fixed.

[III]   Operating EBL and VRM Concurrently (EBL and VRM)

Procedures

1   Put the cursor on the intersection marker (○ or ●), and press the [ENT] key.

When the cursor is moved to it, EBL1 VRM1 or EBL2 VRM2 is shown at the upper right of the cursor.   The EBL and VRM become operable when the **[ENT]** key is pressed.

2   Move the cursor to the bearing / range to be set.

The EBL and VRM will move as the cursor moves.

3   Press the [ENT] key.

The EBL and VRM will be fixed.

[IV]   Operating Parallel Index Lines (PI)

To change the direction of parallel index lines

Procedures

1   Put the cursor on near the center of line, and press the [ENT] key.

When the cursor is moved there, it will turn into " ↻ " and PI will be displayed at the upper right of the cursor.   The parallel index lines become operable when the **[ENT]** key is pressed.

2   Move the cursor to the direction to be set.

The parallel index lines will change the direction as the cursor moves.

3   Press the [ENT] key.

The parallel index lines will be fixed.

To change parallel index line intervals

Procedures

1   Put the cursor on near the end of line, and press the [ENT] key.

When the cursor is moved there, it will turn into "⬄" and $\boxed{\text{PI}}$ will be displayed at the upper right of the cursor.   The parallel index lines become operable when the **[ENT]** key is pressed.

2   Move the cursor to the interval to be set.

The parallel index lines interval will change as the cursor moves.
If Individual is selected for Operation Mode, the parallel index lines move.

3   Press the [ENT] key.

The parallel index lines will be fixed.

4

To change the end points of parallel index lines

If Individual is selected for Operation Mode, the length of parallel index lines can be changed.

Procedures

1   Put the cursor on the end point of parallel index lines, and press the [ENT] key.

When the cursor is moved there, it will turn into "⬄" and $\boxed{\text{PI}}$ will be displayed at the upper right of the cursor.   The parallel index lines become operable when the **[ENT]** key is pressed.

2   Move the cursor to the position to be set.

The position of the end point will change as the cursor moves.

3   Press the [ENT] key.

The parallel index lines will be fixed.

4.2 MEASUREMENT OF RANGE AND BEARING

Target position on the RADAR screen

RADAR antenna transmits pulses of radio waves.   The object returns the wave (radar echo) to the antenna.
So on the RADAR screen the leading edge of echo is the actual target position.
The length of echo is dependent on the transmitted pulse length.
Point the cursor to the leading edge of echo to measure the target range or to make a mark on the target.
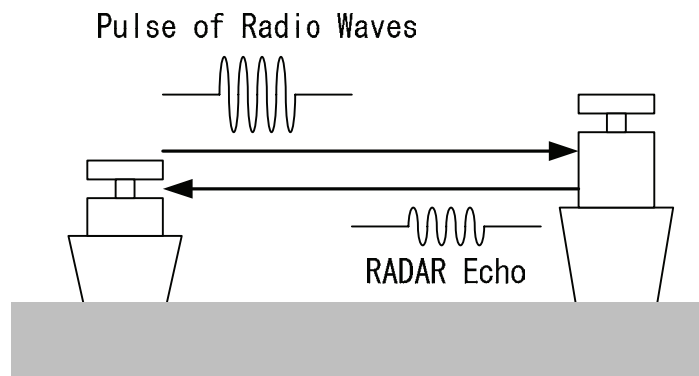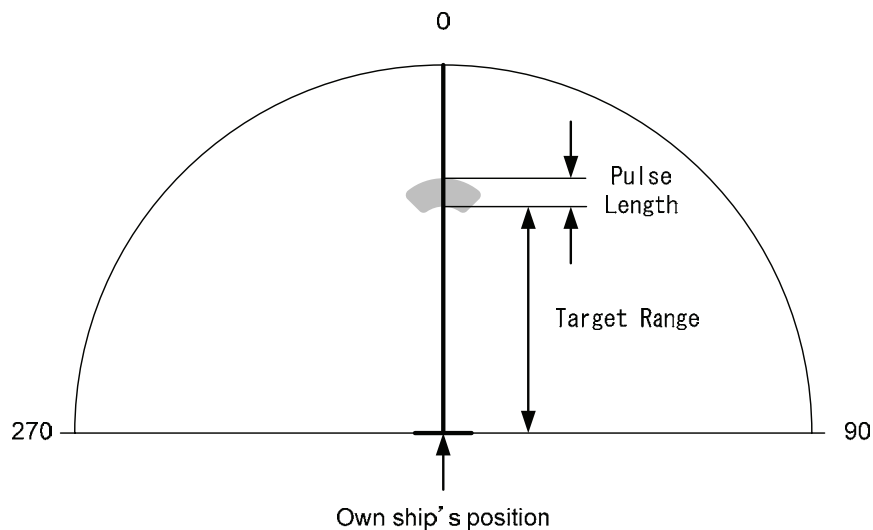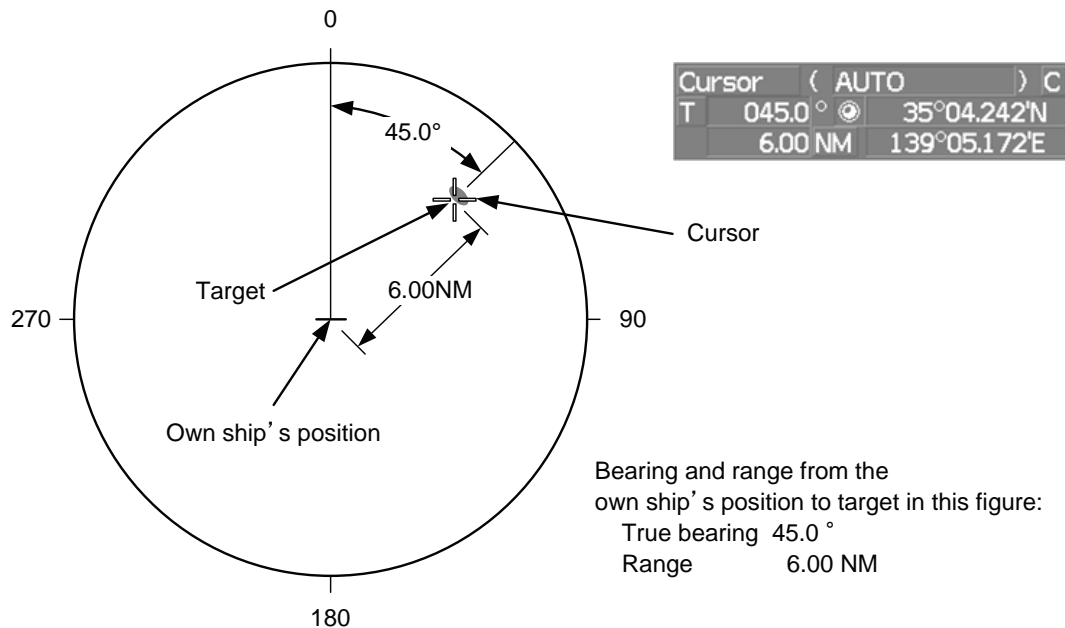

Fig. 4.1 Transmitting-Receiving of RADAR

Fig. 4.2 Relation of echo, target range and pulse length

4.2.1 Measurement with Cursor Position (Cursor)

Procedures   **1   Make sure of the target echoes on the radar display.**

2   Move the cursor to the target.

The bearing and range of the target will be shown in the Cursor bearing / range (upper right of the display on page 2-3).   The range is a distance from the own ship's position.

0

45.0°

Cursor (AUTO) C
T   045.0 ° ◉   35°04.242'N
6.00 NM   139°05.172'E

Cursor

Target

6.00NM

270 ─   ─ 90

Own ship's position

Bearing and range from the
own ship's position to target in this figure:
True bearing 45.0 °
Range   6.00 NM

180

4

To set a cursor bearing numeric value mode

Determine whether to display a cursor bearing in true or relative bearing mode.

Procedures   **1   Put the cursor on the Cursor bearing numeric value indication true / relative switching (upper right of the display ④ on page 2-19), and press the [ENT] key.**

The selected mode is switched as shown below each time the **[ENT]** key is pressed.

T ⇒ R ⇒ T

T   :Cursor bearing is displayed in true bearing mode.
R   :Cursor bearing is displayed in relative bearing mode.

4.2.2 Measurement with Electronic Bearing Line and Variable Range Marker [EBL] [VRM]

Procedures

1   Press the [EBL1] key.

The display in the EBL1 adjustment (upper right of the display ⑤ on page 2-19) will be highlighted, and EBL1 will be shown with a dotted line on the PPI display.

2   Move the EBL1 to the target by turning the [EBL] dial.

The EBL1 bearing will be shown in the EBL1 bearing (upper right of the display on page 2-3).
The EBL1 bearing is the bearing of the target.

3   Press the [VRM1] key.

The display in the VRM1 adjustment (upper right of the display ⑥ on page 2-19) will be highlighted, and VRM1 will be shown with a dotted line on the PPI display.

4   Move the VRM1 to the target by turning the [VRM] dial.

The range of VRM1 from the own ship's position will be shown in the VRM1 range (upper right of the display on page 2-3).

Bearing and range from the own ship's position to target in this figure:
True bearing 45.0°
Range   5.00 NM
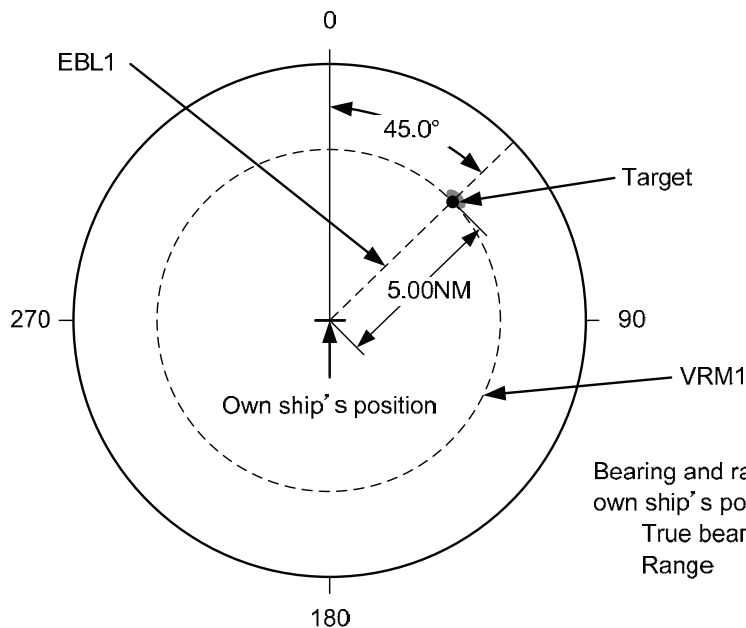
4.2.3 Measurement with Two Arbitrary Points

Procedures

1 Press the [EBL2] key.

The display in the EBL2 adjustment (upper right of the display ⑦ on page 2-19) will be highlighted, and EBL2 will be shown on the PPI display.

2 Press the [EBL] dial to select [C] for the EBL2 starting point mode switching (upper right of the display ⑫ on page 2-19).

3 Put the cursor on the point A of the two points between which measurement is made, and press the [ENT] key.

Refer to the figure below.

4 Move the EBL2 to the other point B by turning the [EBL] dial.

Refer to the figure below.

5 Press the [VRM2] key.

When VRM2 is selected, [●] (intersection marker) will appear on the dotted line of EBL2.

6 Move the intersection marker on the dotted line to point B by turning the [VRM] dial.

The range and bearing between the two points will be shown in the VRM2 range and EBL2 bearing (upper right of display on page 2-3).
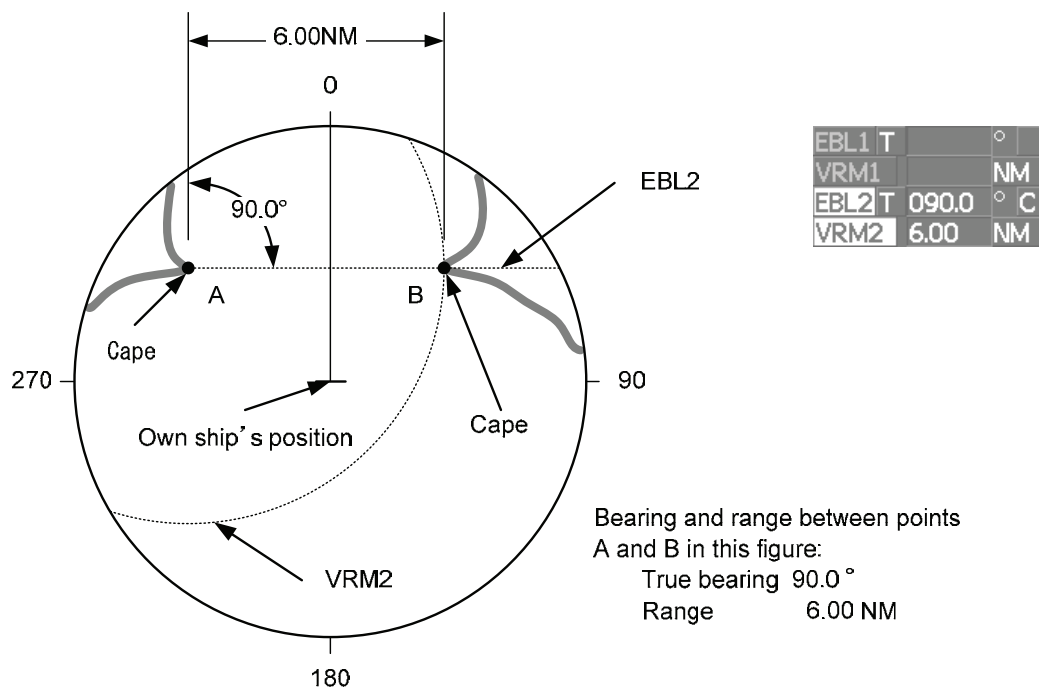
Similarly, EBL1 can also be used for measuring the bearing and range between two points. In this case, perform the above procedure reading EBL2 as EBL1 and VRM2 as VRM1.

SECTION 5
OPERATION OF TARGET TRACKING
AND AIS

USAGE OF TARGET TRACKING FUNCTION

Attention

- There are the following limitations on use of the target acquisition and target tracking functions.

  [I] **Resolution between adjacent targets and swapping during automatic target tracking**
  Depending on the particular distance and echo size, resolution between adjacent targets during automatic target tracking usually ranges somewhere between 0.03 to 0.05 NM. If multiple targets approach each other, resolution will become about 0.05 NM and this may cause the system to regard them as one target and thus to swap them or lose part of them. Such swapping or less of targets may also occur if the picture of the target being tracked is affected by rain/snow clutter returns or sea clutter returns or moves very close to land.

  [II] **Intensity of echoes and the target tracking function**
  The intensity of echoes and the tracking function have a correlationship, and thus the target will be lost if no echoes are detected during six scans in succession. If a lost target exists, therefore, radar gain must be increased to support detection of the target. If, however, radar gain is increased too significantly, sea clutter returns or other noise may be erroneously detected and tracked as a target, and resultingly, a false alarm may be issued.

  [III] **Adverse effects of error sources on automatic tracking**
  To execute accurate tracking, it becomes necessary first to appropriately adjust the [GAIN], [SEA] and [RAIN] dials of the radar so that the target to be acquired and tracked id clearly displayed on the radar display. Inappropriate settings of these adjustments reduce the reliability / accuracy of automatic tracking.

5.1   PREPARATION

This section explains the features of the target tracking and AIS functions, and the initial setting for using each function.

Target Tracking Function (Option)

The target tracking function calculates the course and speed of a target by automatically tracking the target's move.

The target tracking function enables the automatic acquisition of targets by using the automatic acquisition zone function.

The target tracking function also enables the simulation of the ship maneuvering method to avoid collisions by using the trial maneuver function.   (NCA-877WA)

If the mode is ground stabilization, SOG/COG used for own ship's information in target tracking.   If the mode is sea stabilization, SPD (speed through the water) / HDG (heading) used for own ship's information in target tracking.

	Normal edition NCA-877A	High performance edition NCA-877WA
Maximum number of targets that can be tracked	30	100
Trial maneuver function	Not provided	Provided

Note: ARPA Process Unit (NCA-877WA) or ATA Process Unit (NCA-877A) must be fitted on ships compliant to IMO.

AIS (Automatic Identification System) function (Option)

The AIS function shows the target's information on the radar display, using other ship's information sent out from the AIS unit.

Note: AIS Process Unit must be fitted on ships compliant to IMO.

5.1.1 Collision Avoidance

Problems of Collision Avoidance in Navigation

Marine collision avoidance is one of the problems that have been recognized from of old.   Now, it will be described briefly who the collision avoidance is positioned among the navigational aid problems.
The navigation pattern of all mobile craft constitutes a system with some closed loops regardless of the media through which the mobile craft travels, whether air, water, the boundary between air and water, or space.   This pattern consists of two closed loops in principle, one of which is a collision with another mobile craft and the other is a loop of finding a right and safe way to reach a predeterminate destination.   Fig. 5-1 shows the conceptual diagram of navigation pattern by MR. E.W. Anderson.   The closed loop of collision avoidance is shown on the left side and the closed loop of finding a right course on the right side.
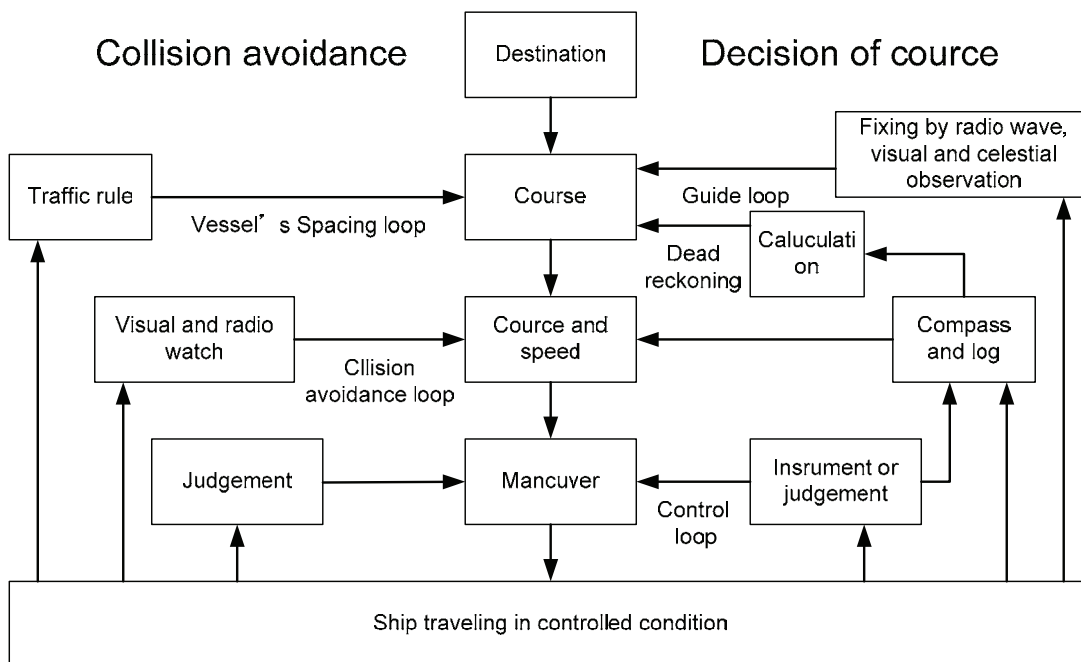
Fig. 5-1   Navigation Pattern

Marine Accidents and Collisions

Among marine accidents, collision accidents have been highlighted as the tonnages and speeds of ships become higher along with the increase in traffic at sea.   If a tanker carrying dangerous articles such as crude oil collides with any other vessel, then not only the vessels involved with the accident but other vessels in the vicinity, port facilities, inhabitants in the coastal area as well as marine resources may also suffer immeasurable damages and troubles.   Collision accidents have a high percentage of the marine accidents that have occurred in recent years.   To cope with these problems, any effective measures are needed and some equipment to achieve collision avoidance requirements have been developed at rapid strides.

Basic Concept of Collision Avoidance

There are two aspects in collision avoidance: collision prediction and avoidance. Collision prediction is to predict that two or more vessels will happen to occupy the same point at the same time, while collision avoidance is to maneuver vessels not to occupy the same point at the same time.
In practical operation of vessels, a spot of collision has to be deemed to be a single point but a closed zone. This closed zone is conceptually defined as a CPA (Closest Point of Approach). In collision prediction, the time to be taken until a ship reaches the CPA is defined as a TCPA (Time to CPA).
Fig. 5-2 shows a diagram caked "Collision Triangle".
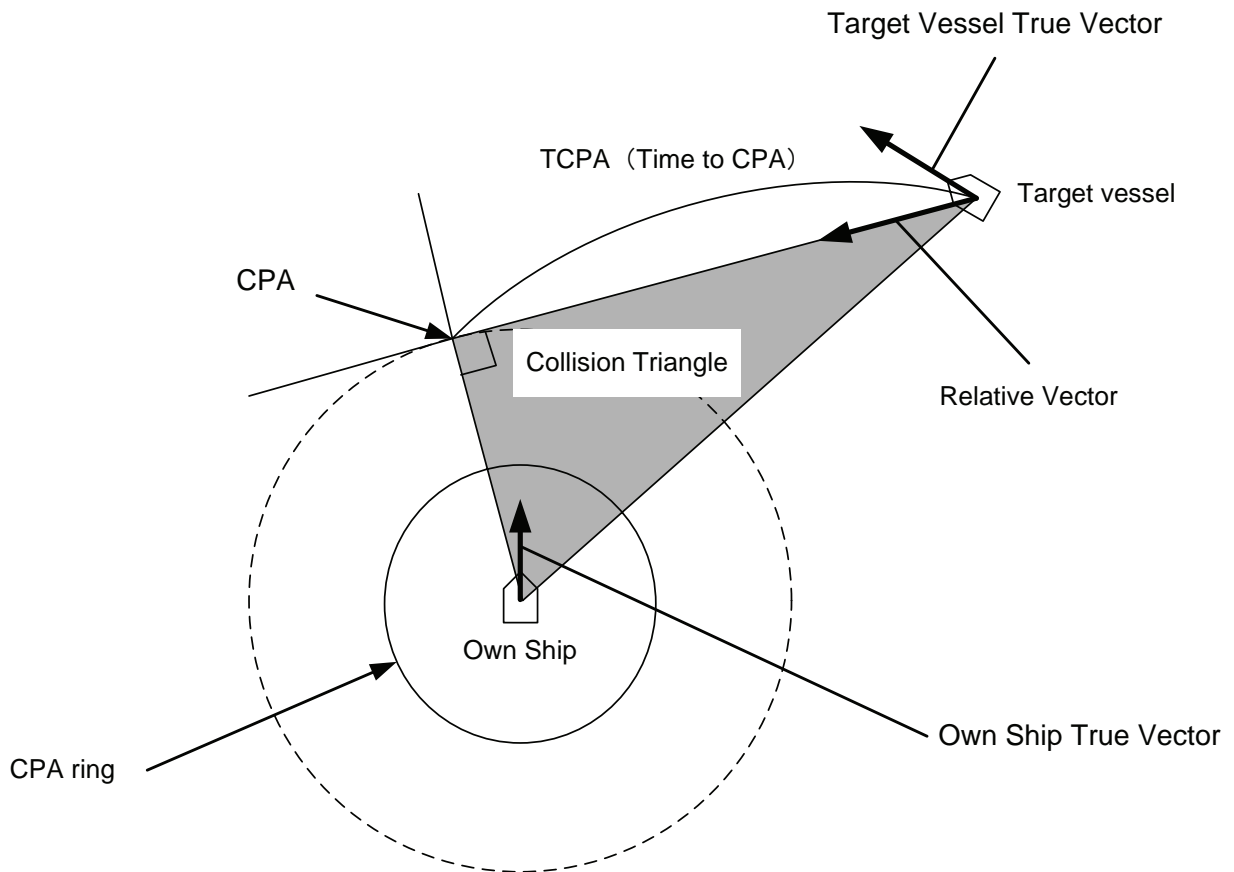
Fig. 5-2   Collision Triangle

Relative Vector and True Vector

From two points of view, collision prediction and avoidance, it is necessary to obtain the relative vector of other ship for prediction and the true vector of other ship for collision avoidance in order to grasp other ship's aspect. The relationship between the relative vector and true vector is shown in Fig. 5-3.
Both rough CPA and TCPA can be obtained easily from the relative speed vector of other ship. This method has an advantage that the risks of collision with all other ships within the radar range can be seen at a glance. On the other hand, the course and speed of other ship can easily be obtained from its true speed vector, enabling other ship's aspect to be seen at a glance. Thus, the aspects of other ships (transverse, outsail, parallel run, reverse run, etc...) as described in the act of prevention of collision at sea can be readily grasped. If there is a risk of collision with other ship, the operator can determine which rule to be applied and how to operate own ship.

V_O: Own ship's speed
θ_O: Own ship's course
V_T: Other ship's true speed
θ_T: Target ship's true course
V_R: Target ship's relative speed
θ_R: Target ship's relative course
θ_A: Aspect
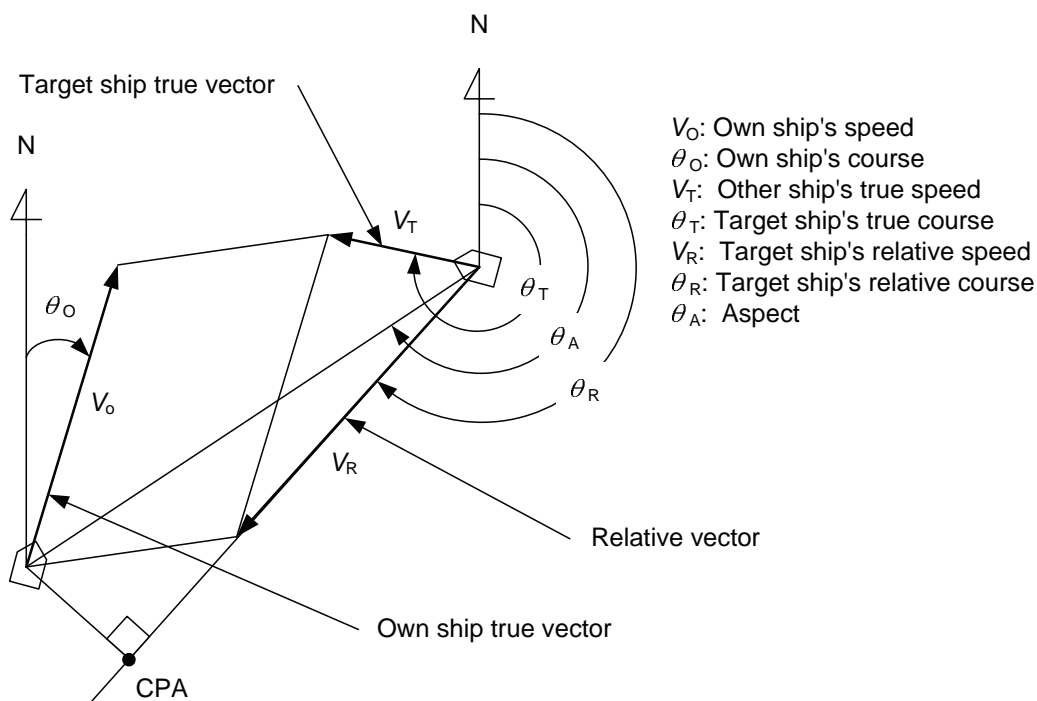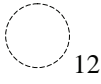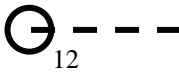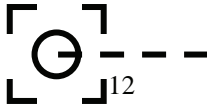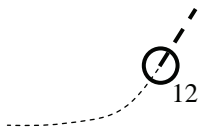
Fig. 5-3 Relative Vector and True vector

Radar and Collision Avoidance

Radar is still playing an important roll for collision prevention and positioning. A plotter is used to further enhance the radar functionality. The plotter is capable of plotting other positions of other ships in 3 to 6 minute intervals to monitor their movement. The plots of other ships represent their tracks relative to own ship, and it is shown whether there is a risk of collision, namely CPA and TCPA can be obtained. This method using a plotter is fairly effective, but the number of target ship, which is manually plotted, is limited and it takes several minutes to measure those.

5.1.2 Definitions of Symbols

Types and Definitions of Target Tracking Symbols

Vector/Symbol	Definition	Remarks
	Initial acquisition target	This symbol is displayed until the vector is displayed after target acquisition.
	Target acquired in automatic acquisition zone	The alarm sounds. The alarm message (New Target) turns red and blinks. The symbol is red colored.
	Tracked target	
	Dangerous target	The alarm sounds. The alarm message (CPA/TCPA) turns red and blinks. The symbol turns red and enlarges.
	Numeric displayed target	When the numeric data is displayed, the target symbol is enclosed in a square.
	Lost target	The alarm sounds. The alarm message (Lost) turns red and blinks. The symbol turns red, and indicates with X mark.
	Past position	The past positions of an AIS target are displayed as well as the target tracking symbol.
	Target track	The track of another ship as an AIS target is displayed as well as the target tracking symbol.

5

Types and Definitions of AIS Target Symbols

Vector/Symbol	Definition	Remarks
	Sleeping target	This symbol is displayed when received data is valid. The direction of the triangle's vertex indicates the target's bow or course.
AIS12	Activated target	The heading direction is displayed with a solid line, and the course vector is displayed with a dotted line. The line perpendicular to the heading direction indicates the direction to which the course is to be changed. This line may not be displayed.
AIS12	Target acquired in automatic acquisition zone	The alarm sounds. The alarm message (New Target) turns red and blinks.
AIS12	Outline display	The outlines of ships are displayed scaled down.
AIS12	Numeric displayed target	When the numeric data is displayed, the target symbol is enclosed in a square.
AIS12	Dangerous target	The alarm sounds. The alarm message (CPA/TCPA) turns red and blinks. The symbol turns red and enlarges.
AIS12	Lost target	The alarm sounds. The alarm message (Lost) turns red and blinks. The symbol turns red, and indicates with X mark.

Up to 300 targets can be displayed in total of activated and sleeping AIS targets. Up to 100 activated AIS targets can be included in the total.

If there are more AIS targets than the allowable maximum, they are displayed in the following priority order:

1. Numeric displayed target
2. Target of which CPA / TCPA is lower than the set value
   (Target as a dangerous ship for which an alarm has occurred)
3. Target in automatic activation zone
4. Activated AIS target
5. Target inside AIS filter
6. Target outside AIS filter

If the number of targets at the same priority level exceeds the allowable maximum, they are displayed in the following priority order:

1. Association target
2. Activated AIS target
3. Sleeping AIS target

The vector of an AIS target is to be displayed with a vector over ground or over water, depending on the speed sensor setting and current offset setting.   The type of the currently displayed vector can be confirmed by viewing the setting of the stable mode.

When   GND   is displayed for the stability mode (upper left of the display on page 2-2):
     Vector over ground
When   Sea   is displayed for the stability mode (upper left of the display on page 2-2):
     Vector over water

When the vector of an AIS target is displayed with a vector over water, the system has converted the AIS target's vector over ground to the vector over water according to the data received from the AIS and the own ship's information.

> **Note:**   When the AIS target's symbol is activated but the vector is not displayed, the following are probable causes of the trouble:
>   COG/SOG is not yet input from the GPS.
>   The selected speed sensor is malfunctioning.

Types and Definitions of Association Target Symbols

When a tracked target and an AIS target are decided as identical, it is displayed with either of the following symbols:

Vector/Symbol	Definition	Remarks
$\oslash$ 12	Priority for tracked target Association target	
$\oslash$ AIS12	Priority for AIS target Association target	

Setting of Tracked Target Symbol Display

This function switches the tracking target symbol display between on and off.
Even if the tracking target symbol display is turned off, the data is retained.

Procedures   **1** **Move the cursor onto the tracking target symbol display On / Off (TT / AIS information ⑨ on page 2-23), and press the [ENT] key.**

The tracking target symbol display will be set to on or off.

Setting of AIS Target Symbol Display

This function switches the AIS target symbol display between on and off.

Procedures   **1** **Move the cursor onto the AIS target symbol display On / Off (TT/AIS information ⑩ on page 2-23), and press the [ENT] key.**

The AIS target symbol display will be set to on or off.

5.1.3 Radar Display

Vector Display

A vector to represent a target's predicted position can be presented in the True vector or Relative vector mode.
In each mode, a vector length can be freely changed for a time interval of 1 to 60 minutes.
To switch between the true vector mode and relative vector mode, press the **[VECT R/T]** key.

[I] Vector Mode Selection

True Vector Mode

In the true vector mode, the direction of a target vector indicates the true course of the target and its vector length is proportional to its speed.
In this mode, own ship's vector is displayed as shown below.
In this mode, the movements of other ships around own ship can be accurately and easily monitored.
However, CPA Ring cannot appear in this mode.

Own ship's position

HL

True vector

The relative vector is not displayed
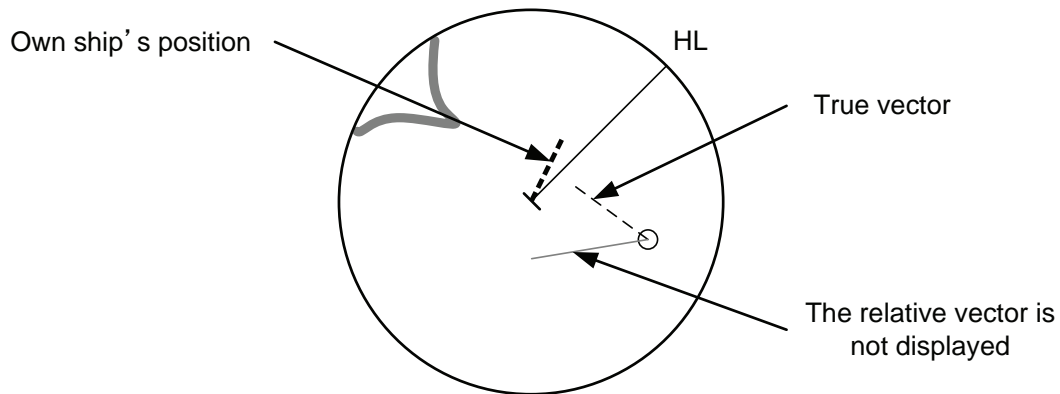
Relative Vector Mode

The relative vector does not represent the true motion of the target, but its relative relation with own ship. This means that a target with its relative vector directed to own ship (passing through the CPA Limit ring) will be a dangerous target.   In the Relative Vector mode, it can be seen at a glance where the CPA Limit of the dangerous target is.

5
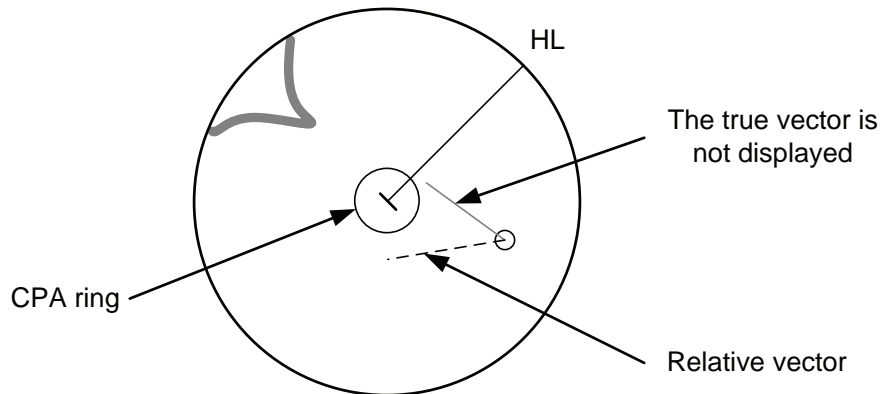
Therefore, the True / Relative mode shall optionally be used for the purpose of observation: the True vector mode for grasping the true aspect of a target, and the Relative vector mode for grasping a target's closest point of approach (CPA).

[II] Vector Length (Vector Time)

The vector length of a target is proportional to its speed, and the vector time can be switched in a range of 1 to 60 minutes.
The diagram below illustrates a vector length of a target for 6 minutes, and the tip of the vector represents the target's position expected to reach 6 minutes later.
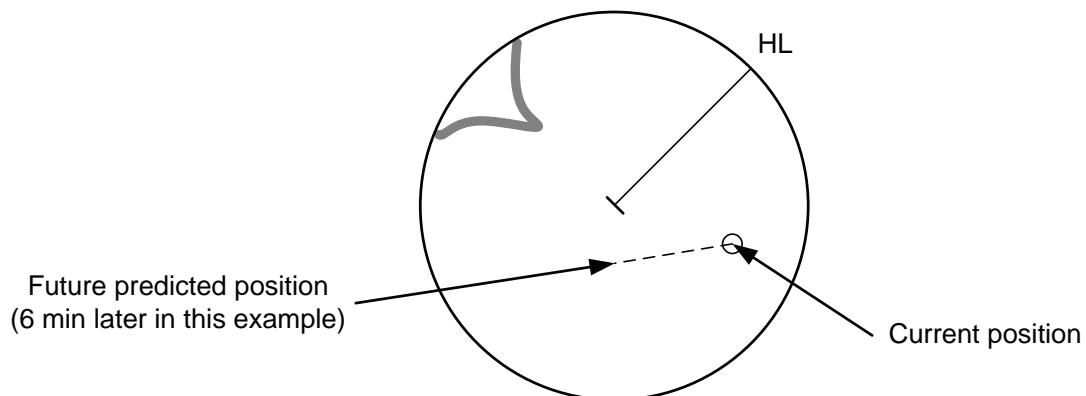
Refer to Section 5.1.7 Setting Vectors for how to change the vector time.

5.1.4 Cursor Modes (Cursor)

Types and Functions of Cursor Modes

The types of cursor modes are listed in the table below.   To use the function of a cursor mode, move the cursor onto the PPI object and press the **[ENT]** key.

Mode	Function
ACQ TT	Enables the target tracking function to acquire a target in manual mode.
ACT AIS	Activates AIS targets, and sets a point filter.
TGT Data	Displays the numeric data of a tracked target or AIS target.
CNCL TT	Cancels a target tracking.
DEACT AIS	Deactivates AIS target.
CNCL Data	Hides the displayed numeric data of a tracked target or AIS target.
Mark	Puts a temporary mark.
Property	Displays the information of tracked targets, AIS targets, and marks.
AUTO	Changes operation in accordance with the object at the cursor position.

Change of Cursor Mode

Procedures   **1 Move the cursor to the cursor mode Cursor (upper right of the display ① on page 2-19), and press the [ENT] key.   On the PPI, press the [CLR / INFO] key and select a desired cursor mode from the list.**

The selected cursor mode will be shown at the cursor mode (upper right of the display on page 2-3).

Note: If the function of a selected cursor mode is not used for one minute or more, the cursor mode is automatically changed to AUTO .

Operation of AUTO Mode

As shown below, the AUTO mode performs operation in accordance with the object at the cursor position when the **[ENT]** key is pressed.

Object at Cursor Position	Operation
None	Acquires a target.
EBL	Performs EBL operation.
VRM	Performs VRM operation.
Intersection point of EBL and VRM	Performs EBL operation and VRM operation at the same time.
Parallel index line (PI)	Operates the parallel index line.
Tracked target	Displays the numeric data of the tracked target.
Tracked target with numeric data displayed	Hides the numeric data.
Sleeping AIS target	Activates the AIS target.
Activated AIS target	Displays the AIS target information.
AIS target with numeric data displayed	Hides the AIS target information.
Automatic acquisition / activation zone	Operates the automatic acquisition / activation zone.
Sector radar alarm zone	Operates the sector radar alarm zone.
AIS filter zone	Operates the AIS filter zone.

5

5.1.5 Setting Collision Decision Criteria

```
┌─────────── Attention ───────────────────────────────────┐
│                                                          │
│  ● Set the optimum values of collision decision          │
│    conditions, depending upon vessel type, water         │
│    area, weather and oceanographic conditions.           │
│    (For the relations between those conditions and       │
│    alarms, refer to section 5.5 Alarm Display.   )       │
│                                                          │
└──────────────────────────────────────────────────────────┘
```

Input of CPA Limit

`Procedures`   **1   Move the cursor to the CPA limit setting (TT/AIS information ③ on page 2-23), and press the [ENT] key.**

The CPA Limit value input screen will appear.

2   Enter the value to be set as a CPA limit.

For inputs to the value input screen, refer to Section 3.3.4.

Input of TCPA Limit

`Procedures`   **1   Move the cursor to the TCPA limit setting (TT/AIS information ④ on page 2-23), and press the [ENT] key.**

The TCPA Limit value input screen will appear.

2   Enter the value to be set as a TCPA limit.

For inputs to the value input screen, refer to Section 3.3.4.

5.1.6 Setting CPA Ring

While the distance of the specified CPA Limit value is used as the radius, the CPA ring is displayed with a red circle.

`Procedures`   **1   Move the cursor to the CPA ring display On / Off (lower right of the display ⑦ on page 2-21), and press the [ENT] key.**

The CPA ring will be displayed.

Note: The CPA ring is not displayed when the true vector mode is selected.

5.1.7 Setting Vectors (Vector Time)

Vector time can be set in minutes in the range 1 to 60 min.
A true vector mode or relative vector mode can be selected.

Setting vector time on the display

Procedures   **1 Move the cursor to the target vector time setting (TT / AIS information ② on page 2-23), and press the [ENT] key.**

The Vector Time value input screen will appear.

2 Enter the value to be set as vector time.

For how to input numeric data on the numeric value input screen, see Section 3.3.4.

5

Setting vector time using the multi-dial [MULTI]

Procedures   **1 Press the [MULTI] dial several times to activate the ⎾Vector⏌ mode.**

⎾Vector⏌ will be displayed in the multi-dial mode (lower left of the display on page 2-3).

2 Turn the [MULTI] dial to set the vector time.

Setting vector mode [VECT R / T]

Procedures   **1 Press the [VECT R / T] key.**

The current vector mode ⎾T⏌ (true vector) or ⎾R⏌ (relative vector) will be displayed in the target vector display true / relative switching (TT / AIS information ① on page 2-23).

5.1.8 Setting the GPS antenna location

Set the GPS antenna location.   Set offset ranges in longitudinal direction and latitudinal direction from the own ship's reference position.

For the setting procedure, refer to Section 7.1.9 Setting of CCRP/Antenna/GPS Antenna Position.

Attention

- **If offset ranges are not set correctly, AIS symbols and radar echoes may be displayed shifted.**

- **When offset ranges are set, latitude and longitude data received from the GPS is offset, and the offset data is displayed as the latitude and longitude of own ship's position.**

5.2 TARGET TRACKING OPERATION

This section explains how to use the target tracking function.
The target tracking function automatically tracks a target, and displays the target's course and speed as vectors.
The target tracking function calculates CPA and TCPA, and issues an alarm as needed.
The tracking data is erased from memory when the power is turned off or during transmission standby.

⚠ CAUTION

Use the radar only as a navigation aid.
The final navigation decision must always be made by the operator him/herself.
Making the final navigation decision based only on the radar display may cause accidents such as collisions or running aground.

Use target tracking function only as a navigation aid. The final navigation decision must always be made by the operator him/herself.
Making the final navigation decision based only on tracking target information may cause accidents.
Tracking target information such as vector, target numerical data, and alarms may contain some errors. Also, targets that are not detected by the radar cannot be acquired or tracked.
Making the final navigation decision based only on the radar display may cause accidents such as collisions or running aground.

In setting an automatic acquisition zone, it is necessary to adjust the gain, sea clutter suppression and rain clutter suppression to ensure that target echoes are displayed in the optimum conditions. No automatic acquisition zone alarms will be issued for targets undetected by the radar, and this may cause accidents such as collisions.

5

5.2.1 Acquiring Target [ACQ]

Target acquisition can be performed on two modes, Automatic and Manual, and both modes can be used at the same time.

Automatic acquisition

Note: If the number of targets being tracked has reached the allowable maximum and other targets (not being tracked) go into the acquisition/activation zone, automatically acquired targets are canceled in ascending order of danger.
The position of the scanner shall be at the centre of the azimuth or range in the acquisition/activation zone.

Turning On / Off the automatic acquisition and AIS activation (AZ Menu)

Procedures

1 Press the [AZ] key for two seconds.

The AZ Menu will appear.

2 Press the [1] or [2] key.

The acquisition / activation zone 1 (AZ1) or acquisition / activation zone 2 (AZ2) will be set to on or off.

| On | :The acquisition / activation zone is turned on.
The mark " ⟨ ⟩ " and target ID number are put to an acquired target and move
with the target.   The vectors are displayed within 1 minute.
AIS targets are activated.

| Off | :The acquisition/activation zone is turned off.
The acquisition/activation zone will disappear from the radar display, but the system continues to track the acquired target.
The activated AIS targets remain activate.

Creating the automatic acquisition and AIS activation Zone

Procedures

1 Press the [AZ] key for 2 seconds.

The AZ Menu will appear.

2 Open the Make AZ menu by performing the following menu operation.

    | 3. Make AZ |

3 Press [1] or [2] key.

The range setting of the acquisition / activation zone 1 (AZ1) or acquisition / activation zone 2 (AZ2) will be started.

4 Set the starting azimuth and range by turning the [EBL] dial and [VRM] dial, and press the [ENT] key.

5 Set the ending azimuth and range by turning the [EBL] dial and [VRM] dial, and press the [ENT] key.

The acquisition / activation zone will be determined.

Setting the [AZ] key allocation (Set AZ Key)

A generally used acquisition / activation zone can be turned on / off by simply pressing the **[AZ]** key.

Procedures

1 Press the [AZ] key for 2 seconds.

The AZ Menu will appear.

2 Open the AZ menu by performing the following menu operation.

    | 5. Set AZ Key |
       → | 1. AZ |

3 Set the assignment of the key.

| On | :Pressing the **[AZ]** key turns on / off the acquisition / activation zone.
| Off | :Pressing the **[AZ]** key does not turn on the acquisition / activation zone.

Note: If the RADAR Alarm key assignment is set, pressing the **[AZ]** key turns on / off the Acquisition Zone at the same time the RADAR Alarm is turned on / off.

Manual Acquisition [ACQ]

Note: If more targets are acquired manually in the condition that the maximum number of targets are under tracking, the targets cannot acquired.

Procedures

1 **Move the cursor onto the target to be acquired, and press the [ACQ] key.**

The target will be acquired and the initial acquisition symbol will be displayed.
The vector will be displayed within one minute.

Target manually acquired.
The initial acquisition symbol is displayed.

Target that has passed for 1 min.
The acquisition symbol and vector are displayed.
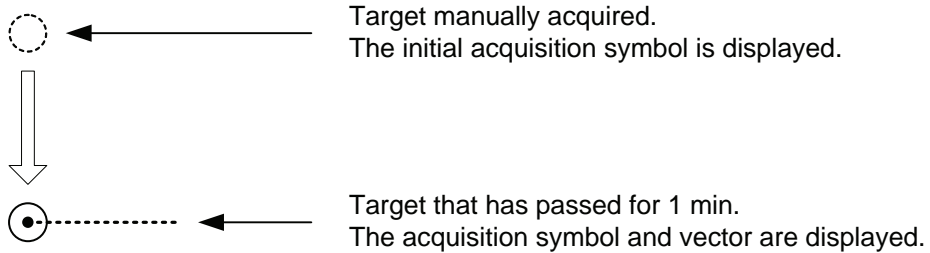
To perform operation only in the manual acquisition mode without automatic acquisition/activation, turn off the automatic acquisition/activation function.

Use of Automatic and Manual Acquisition Modes

Use the manual acquisition mode while the automatic acquisition mode is on.
Manually acquire the target to which particular attention should be paid, and get the other targets automatically acquired.   If a new target appears exceeding the maximum number of targets, the manually acquired target is displayed even in the background until it gets out of the display.   However, automatically acquired targets are canceled starting far distance from own ship.

5.2.2   Canceling Unwanted Tracked Targets [TGT CNCL]

Unwanted tracked targets can be canceled one by one in the following cases:
- Tracking is no longer necessary for targets with which vectors/symbols are displayed after being acquired and tracked.
- The number of vectors on the radar display needs to be reduced for easy observation.
  When targets are to be re-acquired from the beginning, all the current vectors can also be canceled.

Canceling targets one by one [TGT CNCL]

Procedures   **1   Put the cursor on the tracked target to the desired for canceling target, and press the [TGT CNCL] key.**

The vectors and symbols of the tracked targets will disappear, and only the radar video remain.

Canceling all targets collectively [TGT CNCL]

5

Procedures   **1   Press the [TGT CNCL] key for 5 seconds.**

The vectors and symbols of all the targets will disappear, and only the radar videos remain.

Note: When all the targets have been canceled, the system stops tracking them.   Thus, you need to re-acquire targets in manual or automatic acquisition mode.   Do not cancel all the targets unless otherwise required.

5.2.3 Tracked Target Data Display [TGT DATA]

```
┌─ Attention ─────────────────────────────────────────┐
│                                                      │
│  ●  When a target or own ship changes its course, or when │
│     a new target is acquired, its vector may not reach a  │
│     given level of accuracy until 3 minutes or more has  │
│     passed after such course change or target acquisition. │
│     Even if 3 minutes or more has passed, the vector may │
│     include an error depending upon the tracking        │
│     conditions.                                         │
│                                                      │
└──────────────────────────────────────────────────────┘
```

Type of Data Display (Target Information)

Target Data

Target identification (TT ID)	ID number of the target
True bearing (BRG)	0.1° unit
Range	0.01 NM unit
Course	0.1° unit
Speed	0.1 knot unit
Closest point of approach (CPA)	0.01 NM unit
Time to CPA (TCPA)	0.1 min unit
Bow crossing range (BCR)	0.01 NM unit
Bow crossing time (BCT)	0.1 min unit

The target for which its numeric data is displayed is marked with a symbol " ⌐○⌐ " to distinguish from other targets.
If a target's data is displayed, but without the symbol " ○ " , such a target exists outside the currently displayed radar display.

Method of Displaying Numeric Data [TGT DATA]

Procedures   **1   Put the cursor on the tracked target for which numeric data is to be displayed, and press the [TGT DATA] key.**

Then, the data of the designated target will appear, it will be marked with a symbol
" ⌐○⌐ ".   The target data will remain on the radar display until the target is lost and its vector disappears, or until another target is designated.
If a target with the mark " ○ " is designated, only its true bearing and range will appear until its vector appears.

Cancellation of Numeric Data Display (CNCL Data)

| Procedures | 1 | **Put the cursor on the tracked target with which numeric data is displayed, and press the [CLR / INFO] key.** |

The cursor mode list will appear.

2   Press the [6] key.

The numeric value will disappear.

5.2.4   Displaying Target ID No. (Target Number Display)

A target ID number is a value displayed beside the acquisition symbol when a target is acquired.
A target ID number 1 to 100 is assigned to each target in acquisition order.   Once a target ID number is assigned, it identifies the target until the target is lost or the target acquisition is canceled.

| Procedures | 1 | **Press the [TT MENU] key.** |

2   Press the [4] key.

Target Number Display will appear.

3   Press the [numeric] key corresponding to the display method to be set.

On	:Displays target ID numbers.
Off	:Hides target ID numbers.
Target Track	:Displays target ID number with target track.

If there are many tracking targets and their symbol display is confusing, set Target Number Display to off to view the radar display easily.

Note: An ID number is always displayed for only targets with which numeric data is displayed.

5

5.2.5 Adding Tracked Target ID Name (Name)

The system can enter a name for each of tracking targets that have been acquired.

Procedures

1 Put the cursor on the tracked target, and press the [CLR / INFO] key.

The cursor mode list will appear.

2 Press the [8] key.

The TT Target Information will appear.

3 Press the [1] key.

The setting items for ship name (Name) will be displayed.

4 Select the input method.

Data Base : Selection of one of previously input ship names.
When this method is selected, a list of ship names that have been input
by selecting Input will be displayed.

Input : Input of a new ship name.
When this method is selected, the ship name (Name) input window
will open.

Off : Target ship's name is not displayed.

Entering a new ship name (Input)

5 Input a new ship name.

Up to 8 characters can be input as a ship name.
For the input method on the character input screen, see Section 3.3.4.
The input name by selecting Input is saved in Data Base .

Selecting one of previously input ship names (Data Base)

5 Press the [numeric] key corresponding to the ship name to be selected.

The selected ship name will be entered.

* Data Base can contain 30 ship names.

5.2.6 Reference Target (Reference)

The system can display the own ship's speed.   To do so, it sets a reference target by tracking a target for which ground fixed.

Attention

- **The reference target function is to be used if the own ship's speed cannot be displayed normally due to trouble such as a speed sensor malfunction.   Do not use the reference target function except in emergencies.**
- **If the speed or course of the own ship is changed or a new reference target is set, the displayed speed may take 3 minutes or more to reach the specified speed after the speed / course change or the setting.**
  Even after 3 minutes or more has passed, the speed may differ from the specified speed depending on the tracking condition.
- **If a large radar echo such as a land target is set as a reference target, the vectors of the speed and other tracking targets will not be displayed correctly and may cause an accident.**
- **If a sailing ship is set as a reference target, the vectors of the speed and other tracking targets will not be displayed correctly and may cause an accident.**
- **If the** REF. **is selected for the speed sensor, the AIS function cannot be turned on.**
- **If the reference target is lost or the target tracking function is stopped, the speed sensor is placed in manual mode** MAN **.**
- **The loss of a reference target may have a major impact on the accuracy of the results for true speed and true course of the target and that own speed will be degraded.**
- **The reference targets are only used for the calculation of true speed.**

Procedures

1 Tracking a target for which ground fixed.

2 Put the cursor on the tracked target, and press the [CLR / INFO] key.

The cursor mode list will appear.

3 Press the [8] key.

The Property will appear.

4 Press the [3] key.

The reference target function will be set to on or off.

| On | :A reference target is set. |
| Off | :The reference target is canceled. |

5 Put the cursor on the speed sensor switching (Own ship information ② on page 2-22), press the [ENT] key, and select REF. .

The speed of own ship calculated from the reference target will be displayed.

When a reference target is set, the symbol display is changed to " $\bigcirc_R$ ".
Only one target can be set as a reference target.
When a new reference target is set, the previously set reference target is canceled.

Note: If AIS function is set to on, the reference target function cannot be used.

5.2.7 Operation Test (TT Test Menu)

⚠ **CAUTION**

🚫 **Target Tracking Function Test is provided to test if the target tracking function is operating normally.   Thus, do not use the function except when you test the target tracking function.**

In particular, if the operation test mode is used during navigation, pseudo targets appear on the radar display and they are confused with actual targets.

Do not use the mode during navigation.

Otherwise, an accident may result.

The following functions are available for testing the target tracking function:

[I] Test Video	Makes an operation check on the target detection circuit.
[II] TT Simulator	Generates pseudo targets on the radar display in order to test if the target tracking function is operating normally.
[III] Status	Displays the status of the target tracking function.
[IV] Gate Display	Displays the gate size for acquiring / tracking a target.

[I] Test Video

Test Video is used to check whether the video signals under target acquisition and tracking are inputted to and processed in the target detection circuit normally.
However, it is sufficient to check that VDH in Test Video is displayed.

Note: Test Video may not be displayed for a target which is not yet acquired or tracked. Test Video may not be displayed either if the **[GAIN]** dial or **[SEA]** dial is not properly adjusted.

Procedures

1 Press the [TT MENU] key.

2 Open the TT Test Menu by performing the following menu operation.

> 9. TT Test Menu

3 Press the [1] key.

The setting items for Test Video will be displayed.

4 Select the test video to be displayed.

In general, VDH is sufficient for target display checks in test video mode.

If any target displayed clearly in the radar display is not displayed in the Test Video mode, the target detection circuit of the Target Tracking unit may have a trouble

Cancellation

1 Press the [1] key while the TT Test Menu is displayed.

The setting items for Test Video will be displayed.

2 Press the [1] key

The test video display will be turned off.

[II] Target Tracking Simulator

Pseudo targets can be generated in certain known positions to check whether the target tracking units are operating normally.   Since the pseudo targets move depending on known parameters, the values for these pseudo targets can be compared with the known value if the pseudo targets are acquired and tracked, and displayed.   Thus, it can be checked if the system is operating normally.

Procedures

1   Press the [STBY] key.

The equipment will enter the transmission standby state.

2   Press the [TT MENU] key.

3   Open the TT Test Menu by performing the following menu operation.

9. TT Test Menu

4   Press the [2] key.

The setting items for TT Simulator will be displayed.

5   Select the scenario to be set.

The TT Simulator display will be turned on.

6   Press the [TX / PRF] key.

When the TT simulator is active, the character " X " will display at the bottom of the radar display.

Target tracking simulator / scenario

Scenario	Target start point		Target end point		Pseudo-target speed
	Distance	Bearing	Distance	Bearing	
1	3.2 nm	20 °	1 nm	90 °	20 kn
2	6 nm	0 °	0 nm	0 °	10 kn
3	6 nm	every 18 °	1 nm	every 18 °	10 kn
4	6 nm	45 °	1 nm	45 °	105 kn
5	6 nm	45 °	6 nm	150 °	20 kn
6	6 nm	45 °	6 nm	150 °	20 kn

Note: When the simulator is operating, set 0 ° as the heading bearing, and 0 kn as the speed of own ship. When the range between own ship and the pseudo target is 0, the target will disappear.

Cancellation

1   Press the [STBY] key.

The equipment will enter the transmission standby state.

2   Press the [2] key while the TT Test Menu is displayed.

The setting items for TT Simulator will be displayed.

3   Press the [1] key.

The TT Simulator display will be turned off.

[III] Status display (Status)

The current Target Tracking status will appear.

Procedures

1   Press the [TT MENU] key.

2   Open the TT Test Menu by performing the following menu operation.

| 9. TT Test Menu |

3   Press the [3] key.

The setting items for Status will be displayed.

*Constant	: Vector response
*VID Level TD	: Threshold value used for automatic acquisition
*VID Level High	: Threshold value used for tracking
*VID Level Low	: Unused
*Gate Size	: Size of gate used for tracking
*Tracking	: Number of targets currently acquired

[IV]   Gate Display

The gate displays an area monitoring a target using the Target Tracking function.   This radar equipment allows the gate size to change automatically according to target range and size.   User can check the gate size using the following function.

Procedures

1   Press the [TT MENU] key.

2   Open the TT Test Menu by performing the following menu operation.

9. TT Test Menu

3   Press the [4] key.

The gate display mode is switched.

On   : Gate is displayed
Off   : Gate is not displayed

4   Display the numeric value of a target according to Section 5.2.3.

The numeric value of the target will be displayed, and the tracked target symbol will be enclosed in a green gate.

Note: The Target Tracking can display the gate of two targets simultaneously.

Tracked Target symbol   Vector

Echo   Gate (displayed in green)
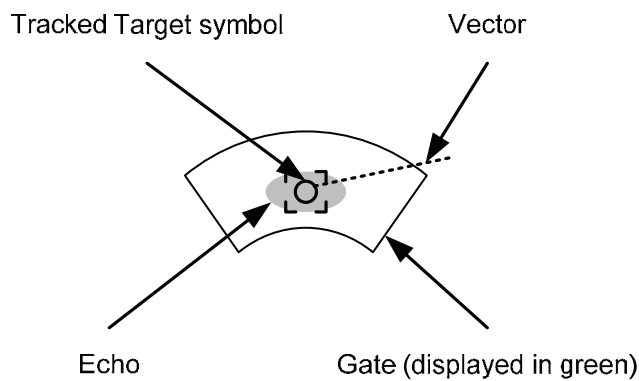
5.3 AIS OPERATION

5.3.1 Restrictions

The following restrictions are placed on use of the AIS function.

- The AIS function is unavailable in the following cases:
  a) $\boxed{\text{MAN}}$ or $\boxed{\text{REF.}}$ is selected for the speed sensor.
  b) The current offset (Set/Drift Setting) is set while $\boxed{\text{LOG}}$ or $\boxed{\text{2AXW}}$ is selected for the speed sensor.
  c) The GPS geodetic system is used except WGS-84.

- $\boxed{\text{LOG}}$ or $\boxed{\text{2AXW}}$ cannot be selected for the speed sensor in the following case:
  The AIS function is turned on and the current offset (Set/Drift Setting) is selected.

- $\boxed{\text{MAN}}$ cannot be selected for the speed sensor in the following case:
  The AIS function is On.

- Current offset (Set/Drift Setting) cannot be turned On in the following case:
  $\boxed{\text{LOG}}$ or $\boxed{\text{2AXW}}$ is selected for the speed sensor while the AIS function is on.

5.3.2 Setting AIS Display Function (AIS Function)

Attention

- **When the AIS function is set to Off, the AIS display function is turned off and AIS symbols are no longer displayed.**
- **Once the AIS display function is set to Off, it is not automatically switched to On even if a dangerous target exists.**

Procedures

1 **Put the cursor on the AIS On / Off (TT / AIS information ⑧ on page 2-23), and press the [ENT] key.**

The received AIS information will be shown on the radar display.

5.3.3 Activate AIS Targets (Activate AIS)

Activate an AIS target, and display the target's vector and make a collision decision.

Manual activation (ACT AIS)

Activate an AIS target in manual mode to display the vector and heading line.

Procedures

1 Put the cursor on the AIS symbol to be activated, and press the [CLR/INFO] key.

The setting items for cursor modes will be displayed.

2 Press the [2] key.

The selected AIS target will be activated.

Automatic activation (AUTO Activate)

Activate an AIS target in automatic mode to display the vector and heading line.
When the automatic activation function is used, AIS targets are automatically activated when they go into the automatic activation zone. The automatic activation zone is identical to the automatic acquisition zone (AZ) used for target tracking. For the zone setting, refer to " Acquiring Target " in Section 5.2.1
The position of the scanner shall be at the centre of the azimuth or range in the acquisition/activation zone. If there are more AIS targets than the allowable maximum, they are deactivated in the low-priority (See the section 5.1.2).

Reference If an AIS target is activated but the vector is not displayed, refer to " Displaying Target ID Number " in section 5.3.6

5.3.4 Deactivate AIS Targets (Deactivate AIS)

Deactivate an AIS target and clear the display of the vector and heading line.

Procedures

1 Put the cursor on the AIS target to be deactivated, and press the [CLR/INFO] key.

The setting items for cursor modes will be displayed.

2 Press the [5] key.

The selected AIS target will be deactivated.

Note: This operation is available only for an activated AIS target.

5.3.5 Displaying AIS Information [TGT DATA]

Types of information displayed

There are two modes (simple and detail) to display AIS target information.   The display items are determined by the selected mode.

Display Item	Detail mode	Simple mode
NAME (ship name)	Up to 20 characters	
Call Sign	Up to 7 characters	
MMSI	Up to 9 characters	
COG (course over ground) or CTW (course through water)	0.1 ° unit	
SOG (speed over ground) or STW (speed through water)	0.1 knot unit	
CPA (closest point of approach)	0.01 nm unit	
TCPA (time to CPA)	0.1 min unit	
BRG (true bearing)	0.1 ° unit	
Range	0.01 nm unit	
HDG (heading bearing)	0.1 ° unit	
ROT (rate of turn)	0.01 °/min	Not displayed
POSN (latitude / longitude)	0.0001' unit	
Destination (waypoint)	Up to 20 characters	
NAV Status	Status (number)	

If the numeric information of ROT is blank, the radar is receiving the AIS data which is cannot displayed. In this case, you can only trust the turning direction which is indicated by the turn indicator.   The turn indicator is displayed on the AIS symbol as the line perpendicular to the heading direction.   (See the Section 5.1.2 "Types and Definitions of AIS Target Symbols")

If the numeric information of SOG or STW is 102.2kn, the target ship's speed is 102.2kn or over.   Then the system cannot calculate CPA and TCPA.   Therefore, missing is indicated in the CPA and TCPA information.

The detail mode displays the numeric data of only a single ship, the simple mode can display the numeric data of up to two ships.

For NAV Status, one of the following statuses is displayed in accordance with Navigation Status:

No.	Status
0	Under Way Using Engine
1	at Anchor
2	Not Under Command
3	Restricted Maneuverability
4	Constrained by Her Draft
5	Moored
6	Aground
7	Engaged in Fishing
8	Under Way Sailing
9	Reserved
10	Reserved
11-14	Reserved
15	Not Defined

Displaying AIS Target Information [TGT DATA]

Procedures   **1   Put the cursor on the AIS target of which information is to be displayed , and press the [TGT DATA] key.**

The information of the selected AIS target will be displayed.

Reference: When the numeric data of a target is displayed but the mark " ⌐ ¬ " is not on the radar display, the target is outside the display.

Canceling AIS Target Information Display (CNCL Data)

Procedures   **1   Put the cursor on the activated AIS target of which information display is to be cancelled, and press the [CLR / INFO] key.**

The setting items for cursor modes will be displayed.

2   Press the [6] key.

The information display of the selected AIS target will be cleared.

Selecting Detail / Simple Mode for AIS Target Information Display

Procedures   **1   Put the cursor on the detail/simple display switching (AIS target information ① on page 2-25), and press the [ENT] key.**

The detail or simple mode display for AIS target information will be selected.

5

Message

Received AIS messages can be displayed.
Up to 10 messages of addressed message and up to 10 messages of broadcast message can be displayed.
If the number of messages exceeds 10, the oldest received messages are sequentially deleted.

Displaying Message Selected from List (Message)

Procedures

1   Press the [RADAR MENU] key twice.

2   Open the Message menu by performing the following menu operation.

> 7. AIS Menu
> → 7. Message
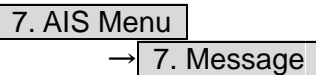
3   Press the [1] or [2] key.

Pressing **[1]** key lists addressed messages; pressing **[2]** key lists broadcast messages.
Each list shows ship names and message-received time.
For an unread message, ☐ * ☐ is displayed to the left of the item number.

4   Press the [numeric] key corresponding to the message to be displayed.

The message will appear.

Displaying Specified Target's Message

Procedures

1   Display AIS target information.

If there are messages from the target, a message mark will be displayed in the unread message display field (AIS target information ② on page 2-25).

2   Put the cursor on the unread message display (AIS target information in ② on page 2-25), and press the [ENT] key.

The message will appear.

Deleting Message (Delete)

Procedures

1   Press the [1] key while the message is displayed.

The Confirmation Window will appear.

2   Press the [1] key.

The message will be deleted, and the ship name and message-received time will disappear from the list.

Displaying Data of Lost AIS Target (Display Lost TGT Data)

The data of the last-lost AIS target can be displayed.
The data of only one target that has been lost most recently can be displayed.

Procedures   **1   Press the [RADAR MENU] key twice.**

2   Open the Display Lost Target Data menu by performing the following menu operation.

| 7. AIS Menu |
→ | 8. Display Lost TGT Data |

The data of the last-lost AIS target will be displayed.

Displaying Own Ship's AIS Data (Own Ship's AIS Data)

The AIS data of own ship can be displayed.

Procedures   **1   Press the [RADAR MENU] key twice.**

2   Open the Own Ship's AIS Data menu by performing the following menu operation.

| 7. AIS Menu |
→ | 9. Own Ship's AIS Data |

The own ship's AIS data will be displayed.

5

5.3.6 Displaying Target ID No. (Target Number Display)

When an AIS target is activated, a target ID number is displayed next to the AIS target symbol.
A target ID number 1 to 100 is assigned to each target in activation order. Once a target ID number is assigned, it identifies the target until the target is lost or deactivated.

Procedures   **1   Press the [RADAR MENU] key twice.**

2   Open the Target Number Display menu by performing the following menu operation.

| 7. AIS Menu |
→| 5. Target Number Display |

3   Press the [numeric] key corresponding to the display method to be set.

| On | : Displays target ID numbers.
| Off | : Hides target ID numbers.
| Target Track | : Displays target ID number with AIS track.
| Ship's Name | : Displays the ship's name.

If there are many tracking targets and their symbol display is confusing, set Target Number Display to off to view the radar display easily.

Note: An ID number or ship's name is always displayed for only targets with which numeric value is displayed.

5.3.7 Setting AIS Filter (AIS Filter Setting)

About an AIS filter

By setting an AIS filter, an AIS target in the area can be displayed by priority or only the targets in the area can be displayed. An AIS filter is initially set in a circle having a radius of 20 [nm] from the CCRP. If 301 or more AIS targets exist in the filter range, they are displayed in the priority order explained in Section 5.1.2 Symbols - Types and Definitions of AIS Target Symbols.

Types of AIS Filters (Filter Type)

There are the following 3 types of AIS filters:
| Range | :A filter is set in a circle with a set range as the radius.
| Sector | :A filter is set in a sector formed by two bearings with the bow as reference.
| Zone | :A filter is set in a zone formed by two bearings and two ranges with the bow as reference.

Procedures   **1   Put the cursor on the AIS filter mode switching (TT / AIS information ⑫ on page 2-23), and press the [ENT] key to select the filter to be set.**

The AIS filter will be selected.

Creation of AIS Filter (Make AIS Filter)

Procedures   **1   Press the [RADAR MENU] key twice.**

2   Open the AIS Filter Setting menu by performing the following menu operation.

7. AIS Menu
→ 4. AIS Filter Setting

3   Press the [2] key.

The mode to make an AIS filter will be activated.

[I]   Setting Range Filter

4   Set a filter range by turning the [VRM] dial, and press the [ENT] key.

[II]   Setting Sector Filter

4   Set a starting bearing by turning the [EBL] dial, and press the [ENT] key.

5   Set an ending bearing by turning the [EBL] dial, and press the [ENT] key.

[III]   Setting Zone Filter

4   Set a starting bearing and range by turning the [EBL] dial and [VRM] dial, and press the [ENT] key.

5   Set an ending bearing and range by turning the [EBL] dial and [VRM] dial, and press the [ENT] key.

Note: When the automatic activation function is enabled, the filter range is automatically changed for covering the automatic activation zone.   Thus, the automatic activation zone is always within the filter range.

AIS Filter Display On/Off (Filter Display)

Procedures   **1   Press the [RADAR MENU] key twice.**

2   Open the AIS Filter Setting menu by performing the following menu operation.

7. AIS Menu
→ 4. AIS Filter Setting

3   Press the [3] key.

Filter Display will be set to on or off.

Display of Targets outside AIS Filter (Filter Mode)

Procedures

1   Press the [RADAR MENU] key twice.

2   Open the Filter Mode menu by performing the following menu operation.

   7. AIS Menu
   → 6. Filter Mode
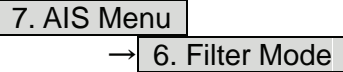
3   Press the [6] key.

The Filter Mode is switched.
Display   : Displays only AIS targets in the AIS filter.
Priority   : Displays AIS targets in the AIS filter by priority, and also displays targets outside the AIS filter.

Note: Activated AIS targets can be displayed even when they are outside the AIS filter.

Point Filter

AIS targets which are not displayed because they are outside the AIS filter or at low priority levels can be activated by giving a higher priority to them.

Procedures

1   Put the cursor on the position where a point filter is to be set, and press the [CLR / INFO] key to select the filter to be set.

The setting items for cursor modes will be displayed.

2   Press the [2] key.

A point filter will be set at the cursor position.
If an AIS target is in the point filter, it will be activated.
When an AIS target is activated or an AIS target is not found within one minute, the point filter will be cleared.

Note: The point filter's range is 1 nm, and cannot be changed.

5.3.8 Conditions for Deciding AIS Target to be Lost

About a lost target

When the data of an AIS target cannot be received for a specified time, the target is decided to be lost and the target data is deleted. As shown in the table below, the time until target data is deleted varies depending on the class of receive data and the target status.

Deciding AIS Target to be Lost

Target status	Time until data deletion	
	SOLAS ship (Class A)	SOLAS ship (Class B)
Vessel below 3 knots (Class A) or 2 knots (Class B) and it is now at anchor or on the berth	**18 min**	**18 min**
Vessel of 3 knots or more and it is now at anchor or on the berth	**60 sec**	**18 min**
Vessel of 0 to 14 knots (Class B: 0 to 14 knots)	**60 sec**	**180 sec**
Vessel of 14 to 23 knots	**36 sec**	**180 sec**
Vessel of 23 knots or more	**30 sec**	**180 sec**
SAR (Search and Rescue)	**60 sec**	**60 sec**
ATON (Aid to Navigation)	**18 min**	**18 min**
Base Station	**60 sec**	**60 sec**

Reference: When a dangerous target ship is lost, a lost alarm is issued and the symbol changes to a lost symbol. The lost symbol will display continuously on the last-received position.
If the **[ALARM ACK]** key is pressed, the symbol is cleared.

5

5.3.9 Setting Conditions for AIS Alarm (AIS Alarm Setting)

Conditions for issuing a Lost alarm and CPA/TCPA alarm for AIS targets can be set.

Setting of Condition for Lost Alarm

Procedures

1 **Press the [RADAR MENU] key twice.**

2 **Open the AIS Alarm Setting menu by performing the following menu operation.**

> 7. AIS Menu
> → 6. AIS Alarm Setting

3 **Press the [1] key.**

The setting items for Lost Alarm will be displayed.

4 **Press the [numeric] key corresponding to the condition to be set.**

Off	: A lost alarm is not issued.
Danger	: A lost alarm is issued only for AIS targets for which a dangerous target alarm has been issued.
ACT&Danger	: A lost alarm is issued only for activated AIS targets and AIS targets for which a dangerous target alarm has been issued.
ACT&Danger&Select	: A lost alarm is issued only for activated AIS targets, data indicated AIS targets and AIS targets for which a dangerous target alarm has been issued.

Note: A lost alarm is not issued for sleeping AIS targets.

Setting of Condition for CPA/TCPA Alarm

Procedures

1 **Press the [RADAR MENU] key twice.**

2 **Open the AIS Alarm Setting menu by performing the following menu operation.**

> 7. AIS Menu
> → 6. AIS Alarm Setting

3 **Press the [2] key.**

The setting items for CPA/TCPA Alarm is switched.

Off	: A CPA/TCPA alarm is not issued.
ACT	: A CPA/TCPA alarm is issued only for activated AIS targets.
ACT&Sleep	: A CPA/TCPA alarm is issued for all AIS targets on the radar display.

Note: When the Lost Alarm menu set to Off, the CPA ring color changes to dark color.

5.4   DECISION OF TARGETS AS IDENTICAL (ASSOCIATION)

5

⚠ CAUTION

❗ If a great value is set as a condition for deciding targets as identical, a tracking target near an AIS target is regarded as identical to the AIS target and it may not be displayed any more.

For example, when a pilot boat (which is a small target not being tracked) equipped with an AIS function approaches a cargo ship as a tracking target not equipped with an AIS function, the tracking target symbol of the cargo ship may not be displayed any more.

Setting of Function to Decide Targets as Identical (Association)

When an AIS target and a tracking target are decided to be identical, an association symbol is displayed for the targets regarded as identical.   In this case, the AIS target symbol is automatically activated.

Attention

● **Turn off** ⬜ **Association** ⬜ **in order not to make a decision on if targets are identical, or in order to display symbols that have disappeared.**

Procedures   **1   Put the cursor on the association On/Off (TT/AIS information ⑪ on page 2-23), and press the [ENT] key.**

Association will be set to on or off.

Setting of Conditions for Deciding AIS and Tracked Targets as Identical (Association Setting)

Procedures　　1　**Press the [TT MENU] key.**

2　**Press the [1] key.**

The Association Setting menu will appear.

3　**Select and enter the item to be set.**

Conditions for deciding targets as identical will be set.　When the differences of all item between AIS and tracked target are under the set conditions..
Once regard as identical, when one of the differences exceed 125 % of the set condition, they are regarded as dissidence.

* The setting for this function is common to Association Setting in the AIS Menu.

Types of Decision Conditions to be Set

Decision conditions

1. Association	On / Off (Function to decide targets as identical)
2. Priority	AIS / TT (Symbol to be displayed)
3. Bearing	0.0 to 9.9 °
4. Range	0 to 999 m
5. Course	0 to 99 °
6. Speed	0 to 99 kn
7.Applicable AIS Target	ACT or ACT&Sleep (activated AIS target or all AIS target)

5.5 ALARM DISPLAY

Critical alarm messages for Target Tracking (TT) and AIS functions:

Message	Class	Description	ALR No.
CPA/TCPA	Alarm	There is a dangerous target.	301

Alarm messages for Target Tracking (TT) and AIS functions:

Message	Class	Description	ALR No.
AIS Alarm ***	Alarm	AIS alarm (Up to 10 alarm messages can be displayed.).	
AIS Alarm 001	Alarm	Tx malfunction	
AIS Alarm 002	Alarm	Antenna VSWR exceeds limit	
AIS Alarm 003	Alarm	Rx channel 1 malfunction	
AIS Alarm 004	Alarm	Rx channel 2 malfunction	
AIS Alarm 005	Alarm	Rx channel 70 malfunction	
AIS Alarm 006	Alarm	general failure	
AIS Alarm 008	Alarm	MKD connection lost	
AIS Alarm 025	Alarm	external EPFS lost	
AIS Alarm 026	Alarm	no sensor position in use	
AIS Alarm 029	Alarm	no valid SOG information	
AIS Alarm 030	Alarm	no valid COG information	
AIS Alarm 032	Alarm	Heading lost/invalid	
AIS Alarm 035	Alarm	no valid ROT information	
CPA/TCPA	Alarm	There is a dangerous target.	301
Lost	Alarm	Failure in tracking the target that has been under tracking. Failure in receiving AIS target data for a specified time.	
New Target	Alarm	Acquisition or activation of a target in the automatic acquisition / activation zone.	302
RADAR Alarm (In)	Alarm	Targets have entered the radar alarm range.	
RADAR Alarm (Out)	Alarm	Targets have left the radar alarm range.	
REF Target	Alarm	Decrease in the reference target accuracy.	
Trial	Warning	There is a dangerous target, when trial maneuver is active.	

An alarm is displayed in the alarm indication (Alarm on page 2-9)

No Alarm

See also section 9.1.1 "List of Alarm Indications".

⚠ CAUTION

ⓘ Since these alarms may include some errors depending on the target tracking conditions, the navigation officer himself should make the final decision for ship operations such as collision avoidance.
Making the final navigation decision based only on the alarm may cause accidents such as collisions.
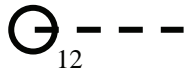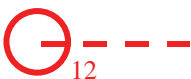
In the system, targets are categorized into two types: tracked / activate AIS targets and dangerous targets. The grade of danger can easily be recognized on the display at a glance.   So the officer can easily decide which target he should pay attention to.
It is not possible to switch off the tracked target visual alarm, unless tracking is ceased, or the alarm condition no longer applies.
The types of target and alarm are shown below.

CPA / TCPA Alarm

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
Tracked target Activated AIS target	⊖ 12 ◁ AIS12	(Off)	(Off)	• CPA > CPA LIMIT • 0 > TCPA • TCPA > TCPA LIMIT The symbol is displayed when one of the above conditions is met.
Dangerous target	⊖ 12 ◁ AIS12 Red blinking	CPA / TCPA	Beep sound (pee-poh) Alarm acknowledgeable	• CPA $\leq$ CPA LIMIT, • 0 $\leq$ TCPA $\leq$ TCPA LIMIT An alarm is issued when all the conditions are met. The AIS targets that issues alarm refer to 5.3.9.

CPA Limit and TCPA Limit: The Setting Values

Alarm for New Target Acquired in Automatic Acquisition Zone (New Target)

<div style="border:1px solid">

⚠ **CAUTION**

! **In setting an automatic acquisition zone, it is necessary to adjust the gain, sea clutter suppression and rain clutter suppression to ensure that target echoes are displayed in the optimum conditions. No automatic acquisition zone alarms will be issued for targets undetected by the radar, and this may cause accidents such as collisions.**

</div>

5

The automatic acquisition function sets a zone in a range and issues an alarm when a new target (which is not yet acquired) goes into this zone.
For the setting of an automatic acquisition zone, refer to " Acquiring Target " in Section 5.2.1.

Alarm for New Target Acquired in Automatic Acquisition Zone

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
New target in automatic acquisition zone	⊙ 12 Red Blinking	New Target	Beep sound (pipi-pipi) Alarm acknowledgeable	The alarm is issued when a new target is acquired in the automatic acquisition zone.

Note: When an already acquired target goes into automatic acquisition zone, the alarm message is not displayed and the buzzer does not sound either.

Lost Target Alarm

┌─ **Attention** ─────────────────────────────────┐
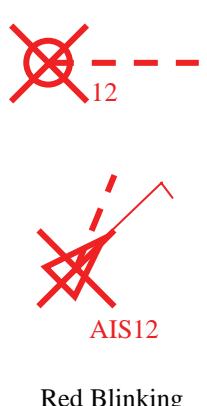
● **If the gain, sea clutter suppression, rain/snow clutter suppression are not adjusted adequately, the lost target alarm may be easily generated.   So such adjustments should be mad carefully.**

└──┘

When it is impossible to continue tracking any acquired and tracked target, or the data of AIS target cannot received for a specified time, the ⌐LOST⌐ alarm will be generated.   The typical causes for alarm generation are shown below, but not limited to the following:

- The target echo is very weak.
- The target is shadowed by a shore or a large ship and its echo is not received.
- The target echo is blurred by sea clutter returns.

If a target under tracking goes out of a range of 32 nm and can no longer be tracked, it is canceled without a lost target alarm.

Lost Target Alarm

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
Lost target	(symbol) 12 (symbol) AIS12 Red Blinking	Lost	Beep sound (pee) Alarm acknowledgeable	The alarm will sound once when a lost target symbol is displayed.

Gyro Set Alarm

The GYRO I/F in this system receives signals from a gyro.   Even if the power is turned off, the system will follow up the gyro.   However, the system stops the follow-up operation when the power of the master gyro is turned off or when any trouble occurs to the line.   When the power of the master gyro is recovered, the ⌐Set Gyro⌐ alarm will be generated.

If this alarm occurs, set the gyro.

Gyro Set Alarm

Alarm characters	Alarm sound	Conditions
Set Gyro	Beep sound (pipi-pipi)	The signals from the gyro are stopped, but the gyro is recovered.

5.6 TRACK FUNCTION

5.6.1 Past Position (Past POSN)

Procedures

1 Put the cursor on the past position display interval unit switching (TT/AIS information ⑦ on page 2-23), and press the [ENT] key to set a desired unit.

The past position display interval unit will be set to ⎢ min ⎢ or ⎢ NM ⎢.

2 Put the cursor on the past position display interval switching (TT/AIS information ⑥ on page 2-23), and press the [ENT] key to set a desired track display interval.

The past position will be set.

⎢ Off ⎢   :Tracks are not displayed.
⎢ Numeric ⎢   :Tracks are displayed at intervals of a specified value.

5

The past position function can display up to 10 past positions of a target under tracking.   The past position display interval can be set to specified time intervals of 0.5, 1, 2, or 4 minutes, or specified range intervals of 0.1, 0.2, 0.5, or 1 nm.

The specified interval is displayed in the past position display interval switching (TT / AIS information ⑥ on page 2-23).   When ⎢ Off ⎢ is displayed, the track display function is turned off.

The track mode operates in conjunction with the vector mode, and a true or relative track is displayed.

In relative vector mode, the relative tracks of the target are displayed.

In true vector mode, true tracks that are calculated from the relative bearing, range, own ship's course, and speed are displayed.

The target is acquisition, past position of traced target is start plot.

The AIS target is displayed, past position of AIS target is start plot.

If the past position plotted time is short, the indicated past position duration may not have achieved the specified time or range.

5.6.2 Target Ship's Tracks (Target Track)

This function makes settings for the tracks of tracked targets and AIS targets.
The system can display the tracks of up to 20 target ships.

[I] Track Color Setting (Target Track Color)

Procedures

1 Put the cursor on the tracked target or activated AIS target, and press the [CLR / INFO] key.

The setting items for cursor modes will be displayed.

2 Press the [8] key.

The TT Target Information will appear.

3 Press the [2] key.

The setting items for Track Color will be displayed.

4 Press the [numeric] key corresponding to the track color to be set.

Colors set by performing the procedure in [III] Setting of Target Ship's Track Colors can be selected.
Individual colors can be set for up to 10 ships.
The same color is set for 11 to 20 ships.

[II]   Target Ship's Track Function On/Off (Target Track Function)

Procedures

1 Open the T.TRK menu by performing the following menu operation.

T.TRK

2 Press the [1] key.

The Target Track Function will be set to on or off.

| On | : Target Track Function is turned on. |
| Off | : Target Track Function is turned off. |

* Note that when this function is turned off, all the other ship's track functions are turned off.   In this case, the track data of other ships is not saved, so they cannot be traced later.

[III]   Setting of Target Ship's Track Colors (Target Track Color)

You can set either one track color for all targets under tracking, or individual colors for the ships of track numbers 1 to 10. The tracks of ships 11 to 20 are displayed in the same color.

*   If the other ship's track function (Target Track Function) is turned off, the track data of other ships is not saved.

Procedures   **1   Open the Target Track Color menu by performing the following menu operation.**
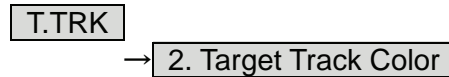
T.TRK
      → 2. Target Track Color

2   Press the [1] key.

The setting items for All will be displayed.

3   Press the [numeric] key corresponding to the track display to be set.

Individual   : Track color is set individually for ships.
Color name   : One color is set for all ships.

5

Individual setting

4   Press the [numeric] key corresponding to the track number to be set.

The setting items for the selected track number will be displayed.

5   Press the [numeric] key corresponding to the track color to be set.

The track color of the selected track number will be set.

When   Individual   is selected, the track numbers   Target Track No. 1   to   No. 10   and the individual setting for   Other   are valid.   Select a color for each target.

The color list is displayed by pressing the **[numeric]** key corresponding to the item number to be set. Select a desired color.   There are 8 color choices: Off ,   White ,   Cyan ,   Blue ,   Green ,   Yellow , Pink , and   Red .

Target Track No. 1   to   No. 10   : Setting for 1 to 10 ships
Other   : Setting for 11 to 20 ships

* Note that the individual setting is not enabled unless   Individual   is selected.

[IV] Setting of Target Ship's Track Display (Target Track Display)

The target track display function can be turned on / off.   Choices for track display are displaying / hiding the tracks of all ships and Individual (displaying the tracks of individual ships).

Procedures

1 Open the Target Track Display menu by performing the following menu operation.
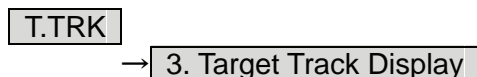
> T.TRK
> → 3. Target Track Display

2 Press the [1] key.

The setting items for All will be displayed.

3 Press the [numeric] key corresponding to the track display to be set.

> Individual : Track display is set for individual ships.
> Off : The tracks of all ships are hidden.
> On : The tracks of all ships are displayed.

* Even when Target Track Display is turned off, the track data of other ships is saved if Track Memory Interval is set.

Individual setting

4 Press the [numeric] key corresponding to the track number to be set.

The selected track number display will be set to on or off.

> On :The track number display is turned on.
> Off :The track number display is turned off.

When Individual is selected, the track numbers Target Track No. 1 to No. 10 and the individual setting for Other are valid.   Select on / off for each target.
> Target Track No. 1 to No. 10 : Setting for 1 to 10 ships
> Other : Setting for 11 to 20 ships

* Note that the individual setting is not enabled unless Individual is selected.

[V]   Setting of Target Ship's Track Saving Interval (Track Memory Interval)

An interval for saving target ship's track data can be set.

*   This function is not available when the Target Track Function is turned off.

Procedures

1   Open the T.TRK menu by performing the following menu operation.

T.TRK

2   Press the [4] key.

The setting items for Track Memory Interval will be displayed.

3   Press the [numeric] key corresponding to the interval to be set.

Select an interval from the following:

Off /
3 sec / 5 sec / 10 sec / 30 sec /
1 min / 3 min / 5 min / 10 min / 30 min / 60 min /
1 NM / 3 NM / 5 NM / 10 NM

5

[VI]   Clear of Target Ship's Track

The target ship's track can be cleared by setting a color or a track number.

*   If Card T.TRK Display is used, target ship's tracks displayed through the card cannot be cleared.

Clear of Tracks by Setting Color (Clear Track Color)

Procedures

1   **Open the T.TRK menu by performing the following menu operation.**

T.TRK

2   **Press the [5] key.**

The setting items for Clear Track Color will be displayed.

3   **Press the [numeric] key corresponding to the color of the target tracks to be cleared.**

The Confirmation Window will appear.

4   **Press the [1] key.**

All the tracks of the selected color will be cleared.

Clear of Tracks by Setting Track Number (Clear Track Number)

Procedures

1   **Open the T.TRK menu by performing the following menu operation.**

T.TRK

2   **Press the [6] key.**

The setting items for Clear Track Number will be displayed.

3   **Press the [numeric] key corresponding to the number of the tracks to be cleared.**

The Confirmation Window will appear.

4   **Press the [1] key.**

The tracks of the selected number will be cleared.

[VII]   Operation of Target Ship's Track Data Saved on Card (File Operations)

Target ship's track data can be saved on a flash memory card and read from the card.

Note: Data can be saved to a flash memory card until the card becomes full, but the number of files that can be read and displayed is limited to 64 in alphanumeric order.   When the number of files has reached 64, delete unnecessary files.

Loading File (Load)

Procedures

1   Insert a flash memory card into the card slot

For the insertion and removal of the card, see HOW TO INSERT AND REMOVE A CARD in the appendix.

2   Open the File Operations menu by performing the following menu operation.

T.TRK
→ 7. File Operations

3   Press the [1] key and select a card slot.

The setting item for Select Card Slot is switched between Slot1 and Slot2.

4   Press the [2] key and select Add or Overwrite.

The setting item for Load Mode is switched between Add and Overwrite.
When Add is selected, new data is added to the current data on the card.   When Overwrite is selected, new data is saved over the current data on the card.

5   Press the [3] key.

Currently saved target ship's track data on the card will be listed.

6   Press the [numeric] key corresponding to the file to be loaded.

The Confirmation Window will appear.

7   Press the [1] key.

The selected target track data will be loaded and shown on the radar display.

Saving File (Save)

1 Insert a flash memory card into the card slot.

For the insertion and removal of the card, see HOW TO INSERT AND REMOVE A CARD in the appendix.

2 Open the File Operations menu by performing the following menu operation.

> T.TRK
> → 7. File Operations

3 Press the [1] key and select a card slot.

The setting item for Select Card Slot is switched between Slot1 and Slot2.

4 Press the [4] key.

The Save menu will appear.

5 Input the file name to be saved.

Up to 10 characters can be input as a file name.
For inputs to the characters input screen, refer to Section 3.3.4.
After the input, the Confirmation Window will appear.

6 Press the [1] key.

The currently displayed target track data will be saved.

Erasing File (Erase)

Procedures

1   Insert the flash memory card into the card slot.

For the insertion and removal of the card, see HOW TO INSERT AND REMOVE A CARD in the appendix.

2   Open the File Operations menu by performing the following menu operation.

T.TRK
→ 7. File Operations
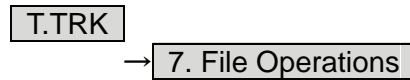
3   Press the [1] key and select a card slot.

The setting item for Select Card Slot is switched between Slot1 and Slot2.

4   Press the [5] key.

The Erase menu will appear.
Currently saved target ship's track data on the card will be listed.

5   Press the [numeric] key corresponding to the file to be erased.

The Confirmation Window will appear.

6   Press the [1] key.

The selected target track data will be erased and the file name will disappear from the list.

Displaying File (Card Target Track Display)

Procedures

1 Insert the flash memory card into the card slot.

For the insertion and removal of the card, see HOW TO INSERT AND REMOVE A CARD in the appendix.

2 Open the File Operations menu by performing the following menu operation.

T.TRK
→ 7. File Operations

3 Press the [1] key and select a card slot.

The setting item for Select Card Slot is switched between Slot1 and Slot2.

4 Press the [6] key.

The Card T.TRK Display menu will appear.
Currently saved target ship's track data on the card will be listed.

5 Press the [numeric] key corresponding to the file to be displayed.

The Confirmation Window will appear.

6 Press the [1] key.

The selected file will be highlighted, and the currently saved target track data will be displayed.

Cancellation

1 Open the Card T.TRK Display window.

The displayed file is highlighted.

2 Press the [numeric] key corresponding to the displayed file.

The Confirmation Window will appear.

3 Press the [1] key.

The file will be deselected and returned to normal display.

5.7 TRIAL MANEUVERING (TRIAL MANEUVER)

> **Attention**
>
> ● **Trial maneuvering is to simulate own ship's course and speed in the conditions that the course and speed of a target ship are unchanged as they are.   As the situation is different from any actual ship maneuvering, set values with large margins to CPA Limit and TCPA Limit.**

5

The trial maneuvering is the function of simulating own ship's course and speed for collision avoidance when a dangerous target appears.   When the own ship's course and speed are entered in manual mode, the trial maneuvering function checks if pre-acquired or pre-activated targets are dangerous.
The ranges of course and speed to be entered manually:

Course: 360 ° (in 0.1 ° intervals) ....**[EBL]** dial
Speed: 0 to 100 kn (in 0.1 kn steps) ....**[VRM]** dial

Trial Maneuvering in the True Vector Mode

In the True Vector mode, calculations are performed according to the values set by Trial Speed, Trial Course and other features, and the result is displayed as a bold-line that represents the change of own ship's vector as shown in the figure below (an example of the course changed to the right).
In this figure, the dangerous target forward left becomes safe as a result of simulation.
The tracked target information indicates the current CPA and TCPA values regardless of the result of simulation.

NORMAL

HL

Own ship's vector

Dangerous target

TRIAL

HL

Route

T

Change of symbol
as a result of
trial maneuver
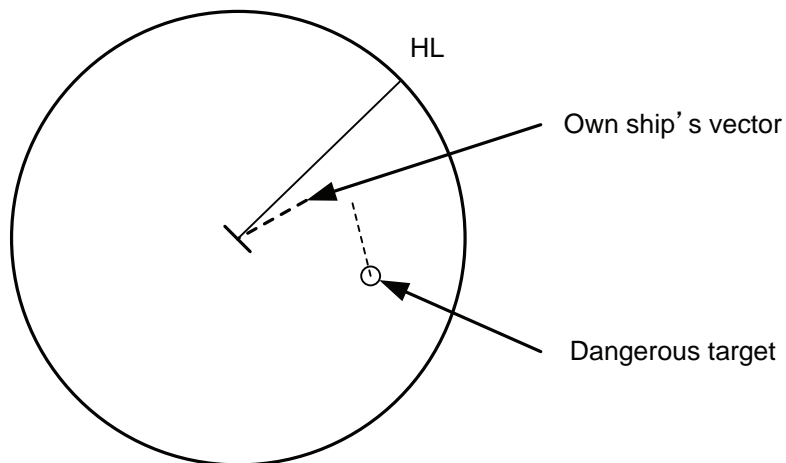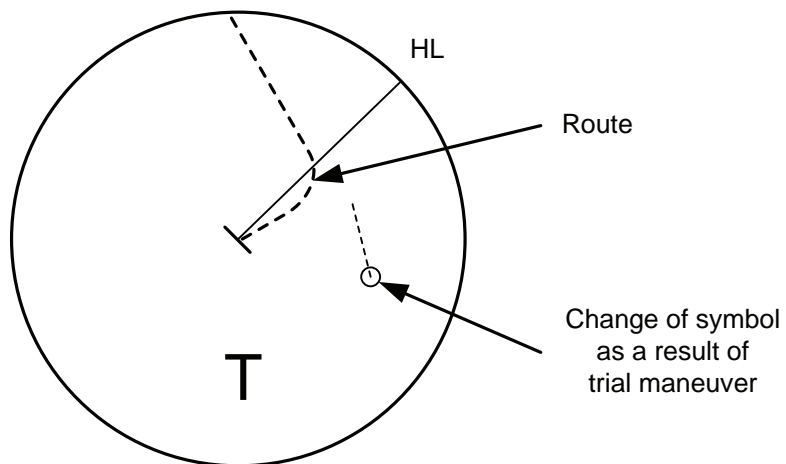
Trial Maneuvering in the Relative Vector Mode

The result of Trial maneuvering in the Relative Vector mode is shown by a change in target vector. In the figure below (in the same conditions as in the True Vector mode in the previous page), it is seen that the acquired target is a dangerous one because its vector is crossing the CPA RING.

NORMAL
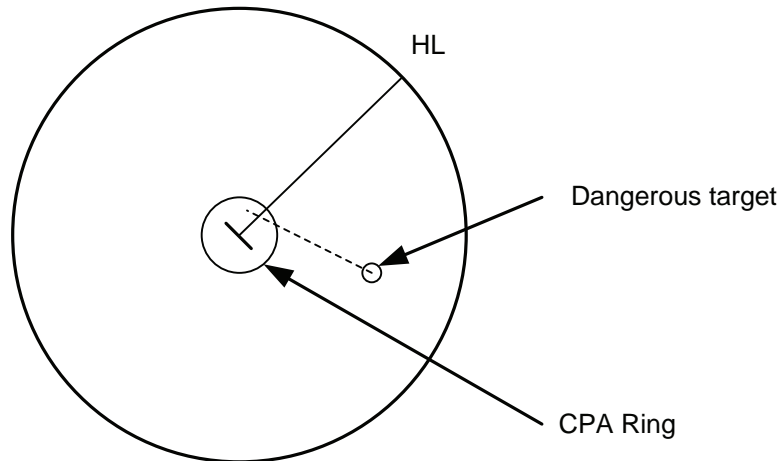
TRIAL
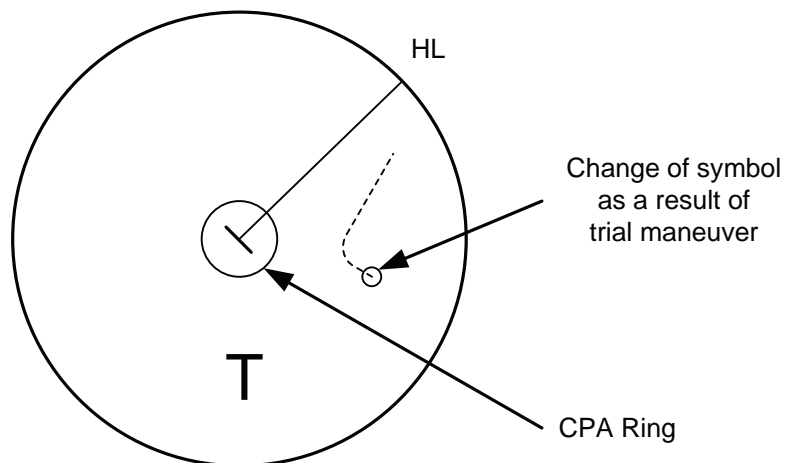
The above figure shows that the relative vector of the target has changed as shown in the figure as a result of simulation (course and speed), so that the symbol color is changed into "White", a safe target.
Irrespective of the simulation results, the current CPA and TCPA values are shown in the tracked target information just like when the true vector mode is active.
The course change of own ship is displayed as a dotted-line.
Better information is provided by using relative motion and sea stabilization.

Operation of Trial Maneuvering Function

Procedures

1   Press the [TT MENU] key.

2   Open the Trial Maneuver menu by performing the following menu operation.

> 3. Trial Maneuver

3   Press the [1] key.

The Trial Function will be set to on or off.

> On   : The trial maneuvering function is turned on.
> Off   : The trial maneuvering function is turned off.

When the Trial Function is active, the character " T " will display at the bottom of the radar display.

4   Set values for Course by turning the [EBL] dial, and for Speed by turning the [VRM] dial.

5   Set other characteristics.

Vector Time	: Vector time (1 to 60 min)
Time to Maneuver	: Time until trial maneuvering is started (0 to 30 min)
Own Ship Dynamic Trait>	: Dynamic trait of the own ship
→ Reach	: Range from when steered to when the ship beings to turn (0 to 2000 m)
→ Turn Radius	: Turning radius (0.10 to 2.00 NM)
→ Acceleration	: Acceleration (0.0 to 100 kn/min)
→ Deceleration	: Deceleration (0.0 to 100 kn/min)

For inputs to the value input screen, refer to Section 3.3.4.

Dangerous target symbols are displayed in red and safe target symbols in white.

*   Vector Time is valid only when Trial Function is set to on.   If it is off, the vector time before trial maneuvering is displayed.
Time until the start of trial maneuvering is counted down immediately after the input.
The acceleration and deceleration are influenced depending on the relationship between the current speed and the input speed for trial maneuvering.
If 0.0 kn/min is set for Acceleration   when the speed for trial maneuvering is faster than the current speed, or for Deceleration   when the speed for trial maneuvering is slower than the current speed, the system performs simulation on the assumption that the speed is changed immediately after the time set for Time to Maneuver .

Cancellation

1   Press the [1] key while the Trial Maneuver menu is displayed.

The Trial Function will be set to on or off.

> Off   : The trial maneuvering function is turned off.

5.8   EPA OPERATION

This section explains how to use the EPA function.
The EPA function is available when a target tracking unit (option) is not connected.
The EPA function saves/displays vectors as the courses and speeds of target ships.
The data of up to 10 target ships (plot/ID numbers 0-9) can be specified.
The EPA function calculates CPA/TCPA, and issues an alarm.
The data of plotted target ships is erased from memory when the power is turned off or transmission standby state.
The EPA function does not display any past plot data.
The past position function is not available.

The EPA function does not calculate BCR or BCT.
The target ID name function is not available.
The automatic acquisition function is not available. (The radar alarm is available.)
The Target Track Function is not available.
The reference target function is not available.
The Trial Maneuver is not available.
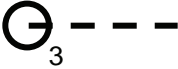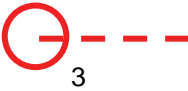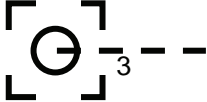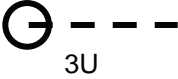
* The setting procedure for target tracking applies to the following:

1. Vector Time
2. CPA Limit
3. TCPA Limit
4. CPA Ring

5

5.8.1 Definitions of Symbols

Types and Definitions of EPA Symbol

Vector/Symbol	Definition	Remarks
⊖3 (dashed circle)	Initial plot	This symbol is displayed when the first plotting is performed. The symbol is displayed until the vector is displayed after the second plotting.
⊖3 (with dashed vector)	Plot vector	
⊖3 (red with dashed vector)	Dangerous plot vector	The alarm message ⌐CPA/TCPA⌐ is displayed The alarm sounds. The symbol blinks red.
⌐⊖3⌐ (enclosed in square)	Numeric displayed plot vector	When the numeric data is displayed, the symbol is enclosed in a square.
○3M	Plot data modification	⌐M⌐ is displayed beside the plot data modification symbol. It is displayed at the previous plotting position.
⊖3U (with dashed vector)	Plot data update request	⌐U⌐ is displayed when the plot data is not updated for 10 minutes. The alarm message ⌐Update EPA⌐ is displayed and the alarm sounds once. If the plot data is not updated within 5 minutes after the alarm, it is erased.

5.8.2 Plotting Targets

Vectors are displayed when a target is plotted twice.
A course and speed are calculated from the two plotting positions, and the plotted target moves in the course at the speed.
The plot can be modified.
The target ID number is not displayed while Display ID Number is set to off.

Procedures

1 Put the cursor on the target, and press the [ACQ] key to start the first plotting.

2 Enter the plot number (target ID number), pressing [0] to [9].

3. Press [ENT] to finish the first plotting.

The symbol and plot number will be displayed at the plotting position.

4 When 30 seconds to 15 minutes has passed after the first plot, Put the cursor on the current target position, and take steps 1 to 3 to perform the second plotting.

When finishing the second plotting, the system clears the symbol and plot number that were displayed at the end of the first plotting, and displays the symbol (vector) and plot number at the second plotting position.

The plotted target (symbol and plot ID number) moves in a specified course at a specified speed. The course and speed are calculated from the two plotting positions. At this time, the CPA and TCPA at positions where the plotted target moves are calculated, and an alarm is issued when the plotted target goes into the dangerous judgment.

5

5.8.3 Modifying Plotted Target Data

The system modifies specified plotted target data.
It clears the specified data, and displays the plotted target immediately before it moves to the clear position until re-acquiring a target.

Procedures

1 Press the [ACQ] key.

2 Enter the plot number (target ID number) for modification, pressing [0] to [9].

3 Press the [CLR / INFO] key.

The previously updated status will be displayed. $\boxed{\text{M}}$ is also displayed beside the mark, indicating that modification is in progress.

4 Put the cursor on the modification position to re-acquire a target, and plotting.

At this time, specify the plot number you entered in step 2.
([**ACQ**], [**0**]-[**9**], [**ENT**])

5.8.4 Canceling Plotted Target Data

The system cancels the display of specified plotted target data.
Once plotted target data is canceled, it cannot be re-saved any more.

Procedures

    1   Press the [ACQ] key.

    2   Enter the plot number for cancellation, pressing [0] to [9].

    3   Press the [TGT CNCL] key.

       The plotted target data of the specified plot number will be canceled.

Canceling all plotted targets

Procedures

    1   Press the [TGT CNCL] key for 5 seconds or more.

       The plotted targets of all the plot numbers will be canceled.

5.8.5 Displaying Numeric Data of Plotted Targets

The following data is displayed for a specified plotted target:

TGT ID	Plot number	
BRG	Bearing	:0.1° unit
Range	Range	:0.01 nm unit
Course	Target's true course	:0.1° unit
Speed	Target's true speed	:0.1 kn unit
CPA	CPA	:0.01 nm unit
TCPA	TCPA	:0.1 min unit
TIME	Elapsed time	:0.1 min unit

Procedures
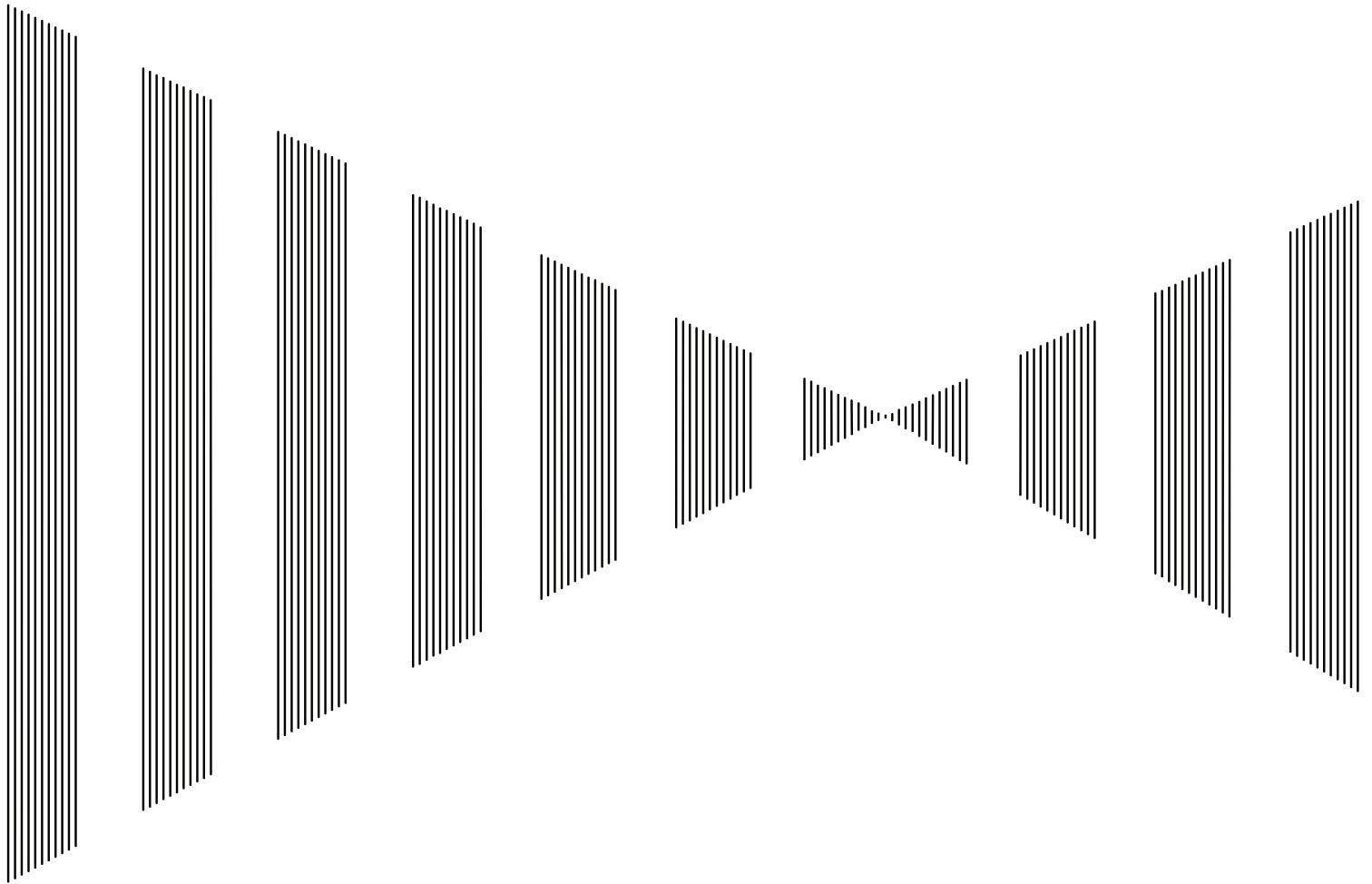
    1   Press the [TGT DATA] key.

    2   Enter the plot number pressing [0] to [9].

    3   Press the [ENT] key.

       The data of the specified plot number will be displayed.
       The mark of the target for which numeric data is displayed is changed into " ⌞O⌝ ".

SECTION 6
TRUE AND FALSE ECHOES ON DISPLAY

The radar operator has a role of interpreting the radar displays to provide his best aid in maneuvering the ship.   For this purpose, the operator has to observe the radar displays after fully understanding the advantages and disadvantages that the radar has.   For better interpretation of radar display, it is important to gain more experiences by operating the radar equipment in fair weathers and comparing the target ships watched with the naked eyes and their echoes on the radar display.

The radar is mainly used to monitor the courses of own ship and other ships in open seas, to check buoys and other nautical marks when entering a port, to measure own ship's position in the coastal waters relative to the bearings and ranges of the shore or islands using a chart, and to monitor the position and movement of a heavy rain if it appears on the radar display.

Various types of radar display will be explained below.

6.1 RADAR WAVE WITH THE HORIZON

Radar beam radiation has the nature of propagating nearly along the curved surface of the earth.
The propagation varies with the property of the air layer through which the radar beam propagates.
In the normal propagation, the distance (D) of the radar wave to the horizon is approximately 10% longer than the distance to the optical horizon.   The distance (D) is given by the following formula:

$D = 2.23(\sqrt{h1} + \sqrt{h2})$(nm)

      h1: Height (m) of radar scanner above sea level
      h2: Height (m) of a target above sea level

Figure 6.1 is a diagram for determining the maximum detection range of a target that is limited by the curve of the earth surface in the normal propagation.
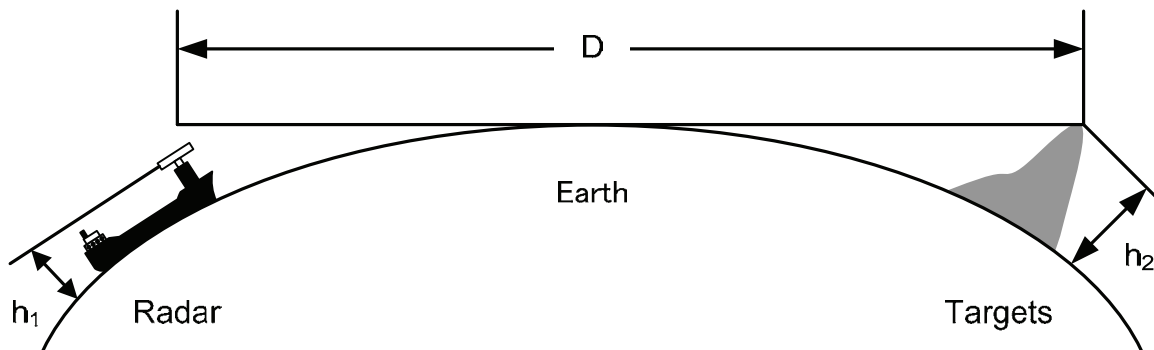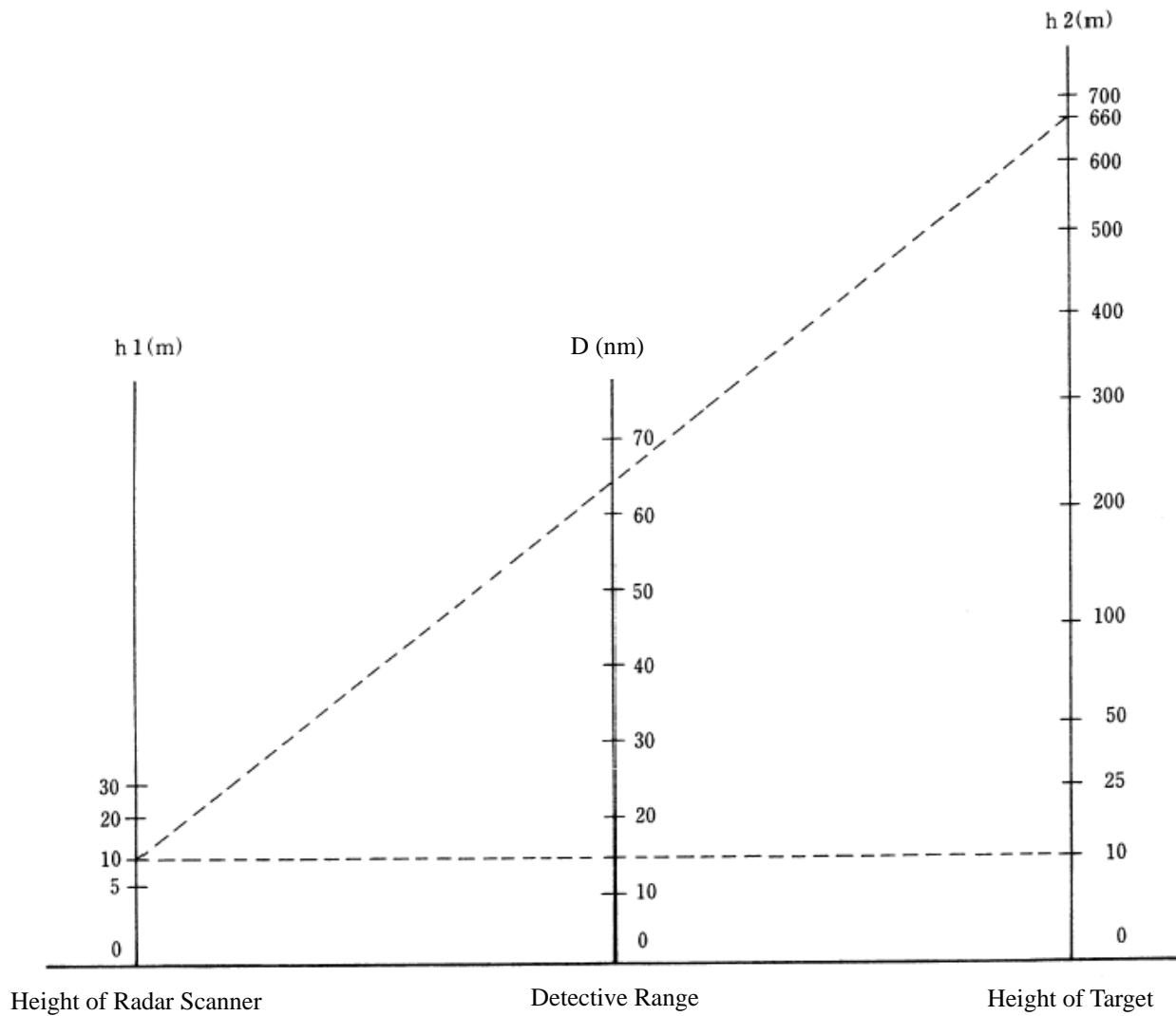
Figure 6.1

When the height of own ship's scanner is 10 m for instance,

(a)   A target that can be detected at the radar range of 64 nm on the radar display is required to have a height of 660 m or more.

(b)   If the height of a target is 10 m, the radar range has to be approx. 15 nm.   However, the maximum radar range at which a target can be detected on the radar display depends upon the size of the target and the weather conditions, that is, the radar range may increase or decrease depending upon those conditions.

6.2 STRENGTH OF REFLECTION FROM THE TARGET

The signal intensity reflected from a target depends not only on the height and size of the target but also on its material and shape.   The echo intensity from a higher and larger target is not always higher in general. In particular, the echo from a coast line is affected by the geographic conditions of the coast.
If the coast has a very gentle slop, the echo from a mountain of the inland appears on the radar display. Therefore, the distance to the coast line should be measured carefully.

Mountain displayed
on the radar display

HL

Sea shore line not displayed
on the radar display.
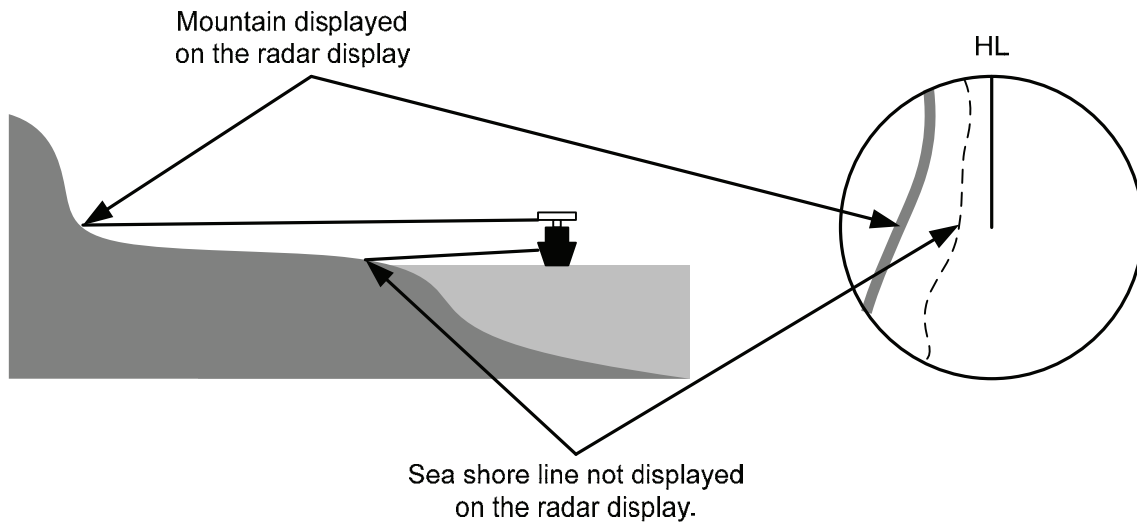
Figure 6.2

Table 6.1 shows the graph indicating the relation between the target detection distance and the radar reflection cross-sectional area (RCS) with regard to the type and the height of the target in a situation in which the weather is good, the sea state is calm and the radio wave propagation is normal.   As revealed by this table, even on the same sea shore line, detection distance greatly differs depending on the height of the target from the surface of the sea.   Furthermore, because the target detection distance is greatly influenced by the shape and material of the target and environmental conditions, such as the sea state, weather, and radio wave propagation, caution should be taken when detecting distance of target.

Table 6.1   Relation between type and height of target and detection distance and RCS

Type of target	Height from sea surface (m)	Detection distance (NM)		RCS (m²)	
		X band	S band	X band	S band
Sea shore line	60	20	20	50,000	50,000
Sea shore line	6	8	8	5000	5000
Sea shore line	3	6	6	2500	2500
SOLAS target ship (>5000GT)	10	11	11	50,000	30,000
SOLAS target ship (>500GT)	5	8	8	1800	1000
Small boat with IMO standard compatible radar reflector	4	5.0	3.7	7.5	0.5
Marine buoy with corner reflector	3.5	4.9	3.6	10	1
Standard marine buoy	3.5	4.6	3.0	5	0.5
10-meter small boat without radar reflector	2	3.4	3.0	2.5	1.4
Waterway location beacon	1	2.0	1.0	1	0.1

Caution: **Detection distance shown in the above table may greatly decrease depending on the shape of the target, sea state, weather and radio wave propagation conditions.**

6

6.3 SEA CLUTTER AND RAIN AND SNOW CLUTTER

In addition to the echo required for observing ships and land radar video image also includes unnecessary echo, such as reflection from waves on the sea surface and reflection from rain and snow. Reflection from the sea surface is called "sea clutter," and reflection from rain and snow is called "rain and snow clutter," and those spurious waves must be eliminated by the clutter rejection function.

[I] Sea clutter

Sea clutter appears as an image radiating outwardly from the center of the radar display and changing depending on the size and the shape of waves. Generally, as waves become larger, image level of the sea clutter is intensified and the clutter far away is also displayed. When waves are large and the sea clutter level is high, it is difficult to distinguish sea clutter from a small boat whose reflection intensity is weak. Accordingly, it is necessary to properly adjust the sea clutter rejection function. Table 6.2 shows the relation between the sea state (SS) showing the size of waves generated by wind and the radar's detection probability.

Table 6.2   Sea state and probability of target detection

RCS	SS1 to 2	SS2 to 3	SS3 to 4	SS4 to 5
$0.1 m^2$	V	V-M	M-NV	
$0.5 m^2$	V	V	V-M	M-NV
$1 m^2$	V	V	V	V-M

S band radar (probability to detect a target at a distance of 0.4 NM)

RCS	SS1 to 2	SS2 to 3	SS3 to 4	SS4 to 5
$1 m^2$	V-M	M-NV		
$5 m^2$	V	V-M	M-NV	
$10 m^2$	V	V	V	V-M

X band radar (probability to detect a target at a distance of 0.7 NM)

V: Detection probability of 80 %

M: Detection probability of 50 %

NV: Detection probability of less than 50 %

As shown in Table 6.3, the number of SS increases as the wind speed becomes high and the waves become large. Table 6.2 reveals that detection probability decreases from V (80 %) to NV (less than 50 %) as the number of SS increases. Therefore, even if the sea state is calm and a target clearly appears on the radar display, when the sea state becomes rough, target detection probability decreases resulting in difficulty of target detection by the radar.

Table 6.3 Relation between Douglas sea state and average wind speed and significant wave height

Sea state	Average wind speed (kn)	Significant wave height (m)
0	<4	<0.2
1	5-7	0.6
2	7-11	0.9
3	12-16	1.2
4	17-19	2.0
5	20-25	3.0
6	26-33	4.0

Significant wave height: an average of top N/3 higher waves when the number of waves detected within a constant time duration is N

For example, in the case of a standard marine buoy, RCS of X band radar is 5 m2 as shown in Table 6.1. When observing such a target in the sea state (SS3) in which significant wave height exceeds 1.2 meters, detection probability is M-NV, as shown in Table 6.2, which indicates 50 % or less.

[II] Rain and snow clutter

Rain and snow clutter is a video image that appears in a location where rain or snow is falling. The image changes according to the amount of rain (or the amount of snowfall). As precipitation increases, the image of rain and snow clutter becomes intensified on the radar display, and in the case of localized heavy rain, an image similar to the image indicating land is displayed in some cases. Furthermore, because radio waves tend to attenuate due to rain and snow, the ability to detect a target in the rain and snow clutter or a target beyond the rain and snow clutter may decrease. The amount of attenuation depends on the transmission frequency, antenna beam width, and the pulse length. Figure 6.3 and Figure 6.4 show examples in which detection distance is reduced due to the influence of precipitation. Because of this, a target, which clearly appeared up to 10 NM by an X band radar (pulse width of 0.8 μs) when it was not raining, may become dimly visible up to 5 NM when the amount of rain becomes 4 millimeters per hour. Furthermore, when comparing the X band radar with the S band radar, target detection distance decreases less when an S band radar is used, which means it is influenced less by precipitation.

6
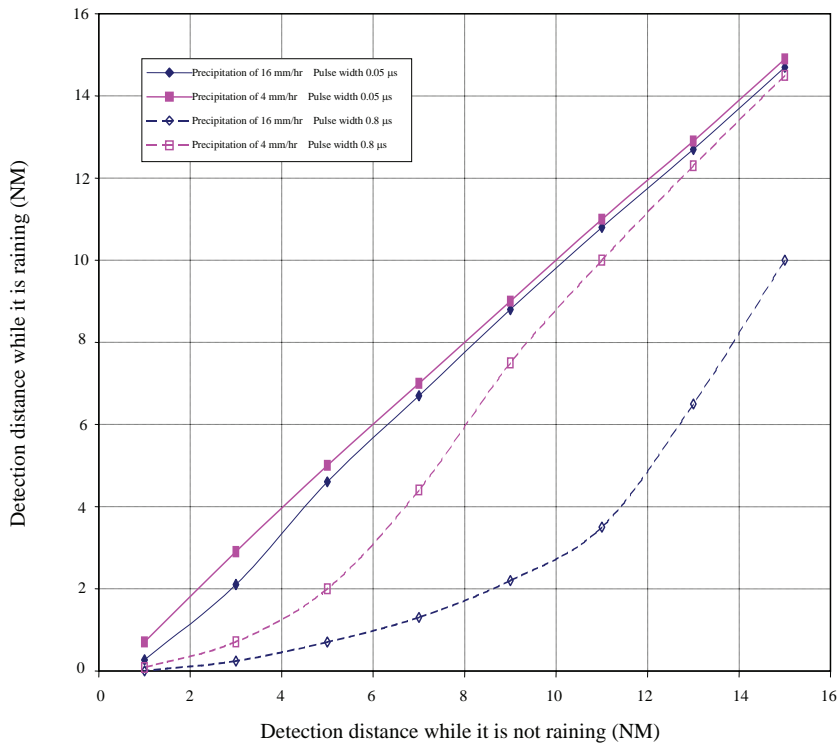
Figure 6.3   Decreased target detection distance by S band radar due to precipitation
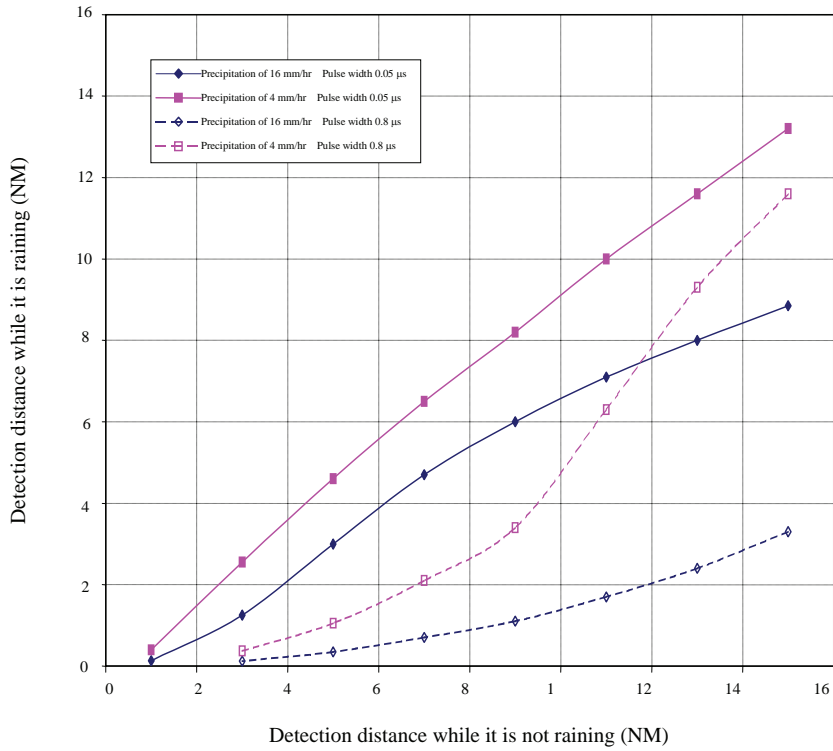
Figure 6.4   Decreased target detection distance by X band radar due to precipitation

[III] Coping with sea clutter and rain and snow clutter

When the weather is bad and the ocean is rough, the use of an S band radar is effective because the radar is not influenced by sea clutter so much and attenuation due to rain drops is small.   When an X band radar is used, reducing the pulse width will reduce the influence by spurious waves, and also the spurious wave rejection function effectively works; therefore, the use of short pulse is effective when the weather is bad.   By using image processing functions PROC 1 to 3, it is expected that spurious waves are further suppressed.   Since optimal settings for those items can be automatically made by using the function mode, it is recommended that   FUNC Storm   or   FUNC Rain   be used by selecting the function mode when the weather is bad.   For details of the function mode, see Chapter 3.9.

However, these functions may make some targets invisible, particularly targets with higher speeds.

6

6.4 FALSE ECHOES

The radar observer may be embarrassed with some echoes that do not exist actually.   These false echoes appear by the following causes that are well known:

[I]   Shadow

When the radar scanner is installed near a funnel or mast, the echo of a target that exists in the direction of the funnel or mast cannot appear on the radar display because the radar beam is reflected on the funnel or mast.   Whether there are some false echoes due to shadows can be checked monitoring the sea clutter returns, in which there may be a part of weak or no returns.
Such shadows appear always in the same directions, which the operator should have in mind in radar operation.

[II]   Side Lobe Effect

A broken-line circular arc may appear at the same range as the main lobe of the radar beam on the radar display.   This type of false echo can easily be discriminated when a target echo appears isolated. (See Figure 6.5)

HL
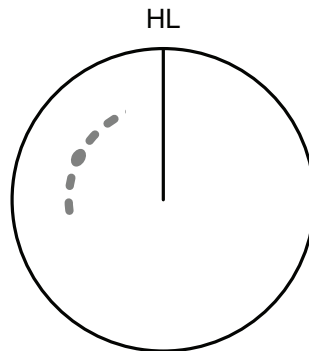
Figure 6.5

[III]   False Echo by Secondary Reflection

When a target exists near own ship, two echoes from the single target may appear on the radar display. One of those echoes is the direct echo return from the target and the other is the secondary reflection return from a mast or funnel that stands in the same direction as shown in Figure 6.6.

Direct microwave

Radar
scanner

Funnel

Secondary reflection
of microwave

HL

Actual target

False echo from funnel

Figure 6.6

6-9
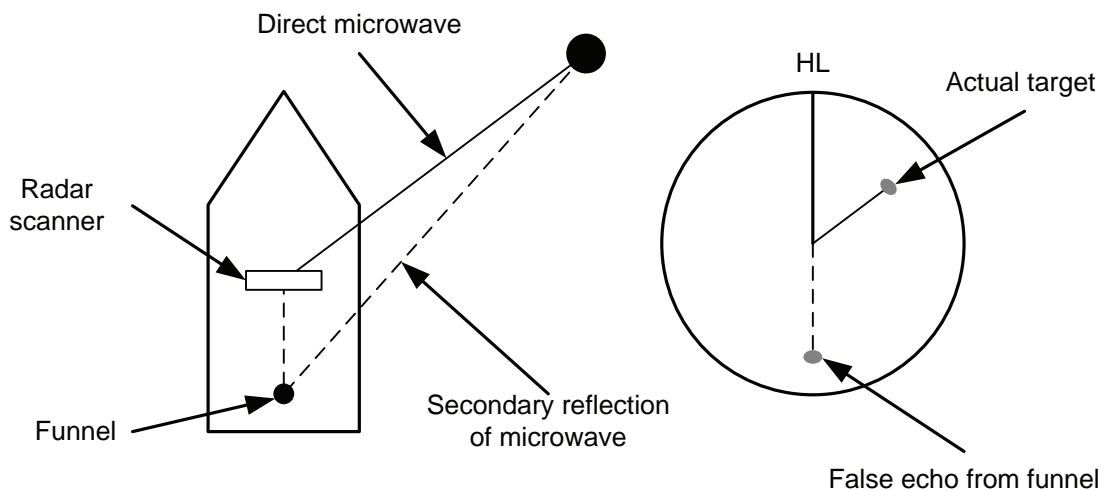
[IV] False Echo by Multiple Reflection

When there is a large structure or ship with a high vertical surface near own ship as shown in Figure 6.7, multiple refection returns may appear on the radar display. These echoes appear in the same intervals, of which the nearest echo is the true echo of the target.

HL
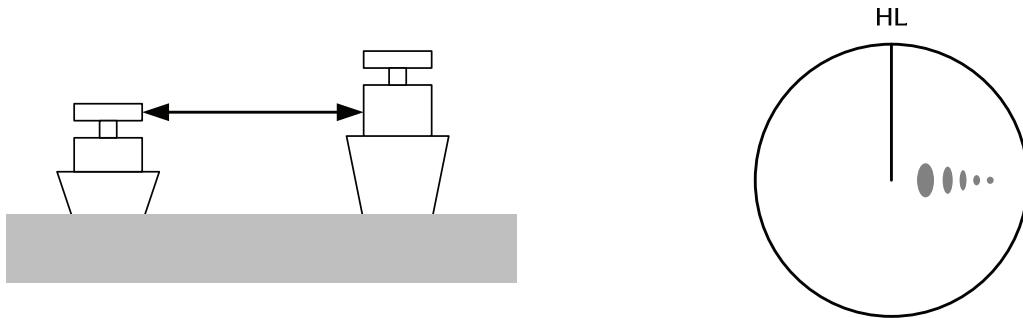
Figure 6.7

[V] Second Time Echoes

The maximum radar detection range depends upon the height of the scanner and the height of a target as described in the section of "The Horizon for Radar Beam Radiation". If a so-called "duct" occurs on the sea surface due to a certain weather condition, however, the radar beam may propagate to a abnormally long distance, at which a target may be detected by the radar.

For instance, assuming that the pulse length is MP3 (on the repetition frequency of 1400 Hz), the first pulse is reflected from a target at about 58 NM or more and received during the next pulse repetition time. In this case, a false echo (second time echo) appears at a position that is about 58 NM shorter than the actual distance. If the false echo appears at 5 NM on the radar display, the true distance of the target is 5+58=63 NM. On the pulse length is SP1 (on the repetition frequency of 2250 Hz), a false echo may appear at a position that is about 36 NM shorter than the actual distance.

This type of false echo can be discriminated by changing over the range scale (the repetition frequency), because the distance of the target changes accordingly.

If second time echo is appeared, the use of Economy mode in PRF menu is effective. Otherwise, Stagger Trigger menu set to on. (See section 3.8.3)

6

[VI] Radar Interference

When another radar equipment using the same frequency band as that on own ship is near own ship, a radar interference pattern may appear on the radar display.   This interference pattern consists of a number of spots which appear in various forms.   In many cases, these spots do not always appear at the same places, so that they can be discriminated from the target echoes.   (See Figure 6.8)
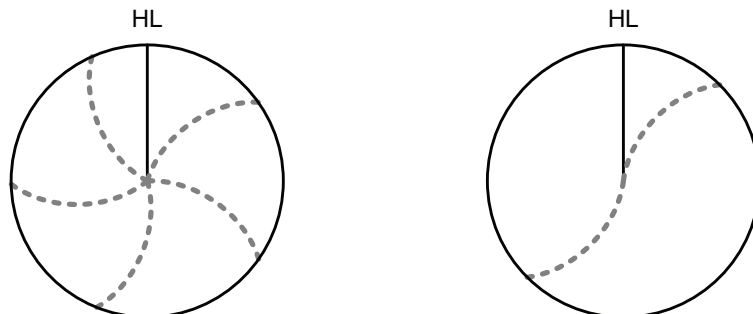
Figure 6.8

If radar equipment causing an interference pattern and this radar are of the same model, their transmitting repetition frequency is nearly the same.   As a result, interference patterns may be displayed concentrically.

In this case, the interference patterns cannot be eliminated by using only the interference reflector function, so press **[TX/PRF]** key several times to fine-tune the transmitting repetition frequency.

An interference suppressing effect can be heightened by applying a different transmitting repetition frequency to the interference pattern source radar and this radar.

6.5 DISPLAY OF RADAR TRANSPONDER (SART)

The SART (Search and rescue Radar Transponder) is a survival device authorized by the GMDSS (Global Maritime Distress and Safety System), which is used for locating survivors in case that a distress accident occurs at sea.   The SART is designed to operate in the 9 GHz frequency band.
When receiving the 9 GHz radar signal (interrogating signal) transmitted from the radar equipment on a rescue ship or search aircraft, the SART transmit a series of response signals to inform the distress position to the rescue and search party.

*   This radar provides a shortcut item to make settings for SART signal reception.   Execution of this item automatically switches to the setting for SART reception.
    It also functions for detect the beacon or target enhancer.

Procedures

1   Press [RANGE +] or [RANGE -] key to set the radar range to 6 NM or 12 NM.

2   Press [RADAR MENU] key twice, and then set the SART display mode according to the procedures below.

2. RADAR Menu
→ 1. Process Setting
→ 9. SART
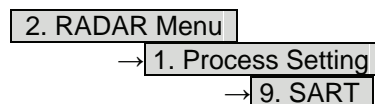
On   : SART On
Off   : SART Off

With the SART display mode set to ON, settings as shown below are made automatically.
(1)   Sea clutter control: Minimum (Most counterclockwise)
(2)   AUTO SEA function: Off
(3)   Rain and Snow Clutter Control (RAIN):   minimum
(4)   Auto Rain and Snow Clutter function (AUTO RAIN):   Off
(5)   TUNE control: No tuning (to weaken clutter echoes)
(6)   Interference rejecter (IR):   Off
(7)   PROCESS: Off

6

Land

SART code

Other Ships

Position of
SART
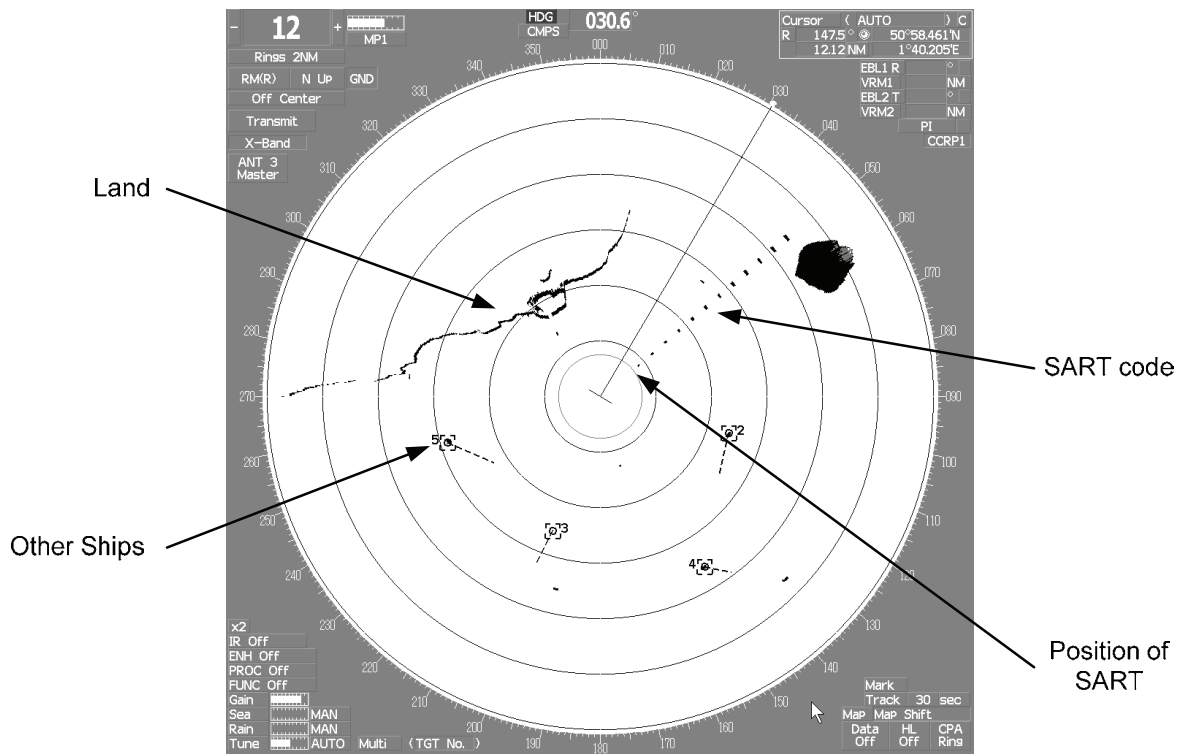
[Example of Display]

Attention

- **When the SART function is set to ON, small targets around own ship will disappear from the radar display.   So it is necessary to exercise full surveillance over the conditions around own ship by visual watch in order to avoid any collision or stranding.**

- **If two or more sets of radar equipment are installed on own ship, use one set of 9 GHz band radar for detection of the SART signal and operate others as normal radars for avoiding collision, monitoring targets around own ship, and checking on own ship's position and avoidance of stranding.**

- **After end of detecting the START signal, turn the START display off.   Then the radar returns normally to the nautical mode.**

SECTION 7
SETTINGS FOR SYSTEM OPERATION

7.1 SETTINGS AT INSTALLATION

This section describes the electrical adjustment procedures to be performed by service engineers during system installation.
The bearing adjustment value is saved to non-volatile memory in the scanner.   Other settings are saviedto non-volatile memory in the radar process unit.

⚠ CAUTION

🚫 **Any adjustments must be made by specialized service personnel.**
Incorrect settings may result in unstable operation.

🚫 **Do not make any adjustments during navigation.   Failure to comply may result in adverse effects on the radar function which may lead to accidents or equipment failure.**

7.1.1   How to Open the Serviceman Menu

Procedures

1. **Press the [RADAR Menu] key for 2 seconds.**

   The Code Input menu will appear.

2. **Press [0] key.**

3. **Put the cursor on the $\boxed{\text{ENT}}$ button, and press the [ENT] key.**

   The Serviceman Menu will appear.

```
           Code Input
  Only for "Service Engineer"

      Press "0" and "ENT"
       to Serviceman Menu

      [              ]


         1   2   3
         4   5   6
         7   8   9
         –   0   +
        CLR   ENT
```
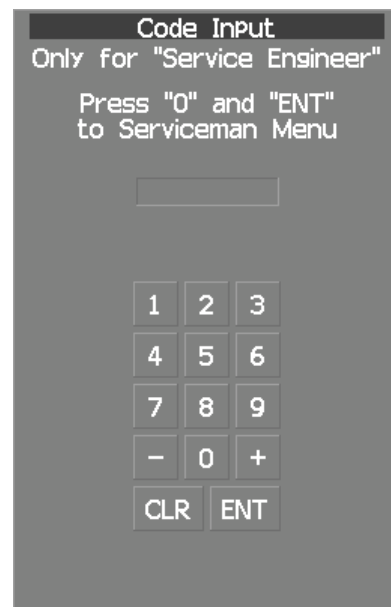
7.1.2   GYRO I/F Setting

The GYRO I/F circuit of the system is designed to be compatible with most types of gyro compasses by simply setting the switches.

Step motor type: 20 to 170 VDC

Synchro-motor type: Primary excitation voltage 35 to 120 VAC

Before power-on operation can be performed, the switches S1 to S5 on the GYRO I/F circuit (PC4201) must be set in accordance with the type of your gyro compass by performing the procedure below.   The switches are factory-set for a gyration ratio of 180X and the step motor type.   Make sure of the type of the gyro compass installed on the own ship before starting the procedure below.

Procedures

1. **Set S1 to "OFF."**

   The gyro compass and GYRO I/F are turned off.

2. **Set S2 and S3 in accordance with the type of your gyro compass.**

   There are two types of gyro compasses: one type outputs a step signal, and the other type outputs a synchro signal.   Make sure of the type of the gyro compass installed on the own ship before setting the switches S2 and S3.

   Synchro signal: Set the switches to [SYNC].

   Step signal: Set the switches to [STEP].

3. **Set the DIP switch S4.**

   The items to be set are listed below.   For the settings, refer to Table 7-1.

   S4-1:   LOG alarm ON/OFF

   S4-2:   GYRO simulator ON/OFF

   S4-3:   LOG simulator ON/OFF

   S4-5:   Time before occurrence of GYRO alarm

   S4-6:   Sensor to be used (GYRO/NMEA)

   S4-7/8:   Baud rate when NMEA is used

4. **Set the DIP switch S5.**

   The items to be set are listed below.   For the setting, refer to Table 7-2.

   S5-1:   Type of gyro signal (step/synchro)

   S5-2/3:   Gyration ratio of gyro compass

   S5-4:   Gyration direction of gyro compass

   S5-5:   Type of log signal (pulse/synchro)

   S5-7/8:   Ratio of log signal

5. **Connect the gyro signal and log signal cables to the terminal block.**

6. **Set S1 to "ON."**

   The gyro compass and GYRO I/F are connected.

7. **After power-on operation, set the true bearing according to Section 7.1.7.**

8. **Make sure of the radar video and the operation with the true bearing value.**

9. **If the true bearing value of the radar equipment is reversed, change the setting of the switch S5-4.**

7

Table 7-1 Setting Table (S4 DIP Switch)

S4 SETTING			1	2	3	4	5	6	7	8
BSHLOG ALM			ON							
			OFF							
GYRO SIMULATOR				ON						
				OFF						
LOG SIMULATOR					ON					
					OFF					
N.C. (No Connection)						OFF				
GYRO ALM TIME					5 SEC		ON			
					0.2 SEC		OFF			
GYRO SRC (Heading Sensor Source)			HDT (NMEA (HDT/THS))					ON		
			GYRO					OFF		
NMEA BAUDRATE			4800 BPS						OFF	OFF
			9600 BPS						ON	OFF
			19200 BPS						OFF	ON
			38400 BPS						ON	ON

Table 7-2 Setting Table (S5 DIP Switch)

S5 SETTING				1	2	3	4	5	6	7	8
GYRO SETTING		STEP		ON							
		SYNC		OFF							
	RATIO	36X			ON	ON					
		90X			OFF	ON					
		180X			ON	OFF					
		360X			OFF	OFF					
		DIRECTION	REV (Reverce)				ON				
			NOR (Normal)				OFF				
LOG SETTING	SYNC (Synchro)							ON			
	PULSE							OFF			
	NC (No Connection)								OFF		
	PULSE/NM		100P／30X							ON	ON
			200P／90X							OFF	ON
			400P／180X							ON	OFF
			800P／360X							OFF	OFF

7.1.3 Tuning

[I] Tune Adjustment

Adjust the tuning control for the transmitter and receiver.
The turning control should be adjusted when the system is installed or when the magnetron is replaced.

Procedures

1. **Set the 48NM range or more..**

2. **Open the Serviceman Menu.**

3. **Open the Tune Adjustment menu by performing the following menu operation.**

   | 1. Adjust Menu |
   → | 1. Tune Adjustment |

   The tune mode switching (lower left of the display ⑫ on page 2-18) is changed to | MAN | .
   The tune dial position (lower left of the display on page 2-3) is changed to mediun value.

4. **Adjust the tune adjustment value so that the tune indicator bar at the upper left of the display is maximized.**

   For how to input numeric data on the numeric value input screen, see Section 3.3.4.

5. **Move the cursor onto the | ENT | button, and press the [ENT] key.**

[II] Tune Indicator Adjustment

Set the scale mark at the time of which tuning reached the maximum point.

Procedures

1. **Set the 48NM range or more..**

2. **Open the Serviceman Menu.**

3. **Open the Tune Indicator Adjust menu by performing the following menu operation.**

   | 1. Adjust Menu |
   → | 4. TXRX Adjustment |
   → | 3. Tune Indicator Adjust |

4. **Adjust the tune indicator adjustment value so that the tune indicator bar at the upper left of the display reaches a point of 80 to 90% of the maximum.**

   For how to input numeric data on the numeric value input screen, see Section 3.3.4.

5. **Move the cursor onto the | ENT | button, and press the [ENT] key.**

7

7.1.4   Bearing Adjustment

Make adjustment so that the bearing of the target measured with the ship's compass matches the bearing of the target echo on the radar display.

Procedures
1. **Select H Up for the bearing presentation.   Set video processing (PROC) to OFF.**

2. **Measure the bearing of an adequate target (e.g., a ship at anchor, a breakwater, or a buoy) relative to own ship's heading.**

3. **Open the Serviceman Menu.**

4. **Open the Bearing Adjustment menu by performing the following menu operation.**

   1. Adjust Menu
       → 2. Bearing Adjustment

5. **Adjust the bearing adjustment value so that the target measured in step 2 is adjusted to the correct bearing.**

   For how to input numeric data on the numeric value input screen, see Section 3.3.4. Make adjustment by the 0.1°.

6. **Move the cursor onto the   ENT   button, and press the [ENT] key.**

7.1.5   Range Adjustment

Make adjustment so that the range of a target on the radar display is shown correctly.

Procedures
1. **Search the radar display for a target of which range is already known.**

2. **Open the Serviceman Menu.**

3. **Open the Range Adjustment menu by performing the following menu operation.**

   1. Adjust Menu
       → 3. Range Adjustment

4. **Adjust the range adjustment value so that the target measured in step 1 is adjusted to the correct range.   (For inputs to the value input screen, refer to Section 3.3.4.)**

5. **Move the cursor onto the   ENT   button, and press the [ENT] key.**

7.1.6   Navigator Setting (Device)

Determine whether to connect navigators to the radar equipment.
Only the navigators set to ON here can be used.

Procedures   1.   **Open the Serviceman Menu.**

2.   **Open the Device Installation menu by performing the following menu operation.**

> 2. Installation Menu
> → 9. Next
> → 3. Device Installation
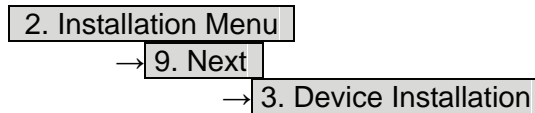
3.   **Select   On   for navigators connected to the radar equipment, and   Off   for navigators not connected.**

GYRO	: Gyro (via GYRO I/F)
Compass	: Compass (Compliant with IEC61162)
GPS Compass	: GPS compass produced by JRC
Log	: Log (via GYRO I/F)
2AXW	: 2-axis log (Speed over water: Compliant with IEC61162)
2AXG	: 2-axis log (Speed over ground: Compliant with IEC61162)
GPS	: GPS (Compliant with IEC61162)

7.1.7   Setting of True Bearing Value

7

If GYRO I/F is used to input a gyro signal, the true bearing value indicated by the master gyro does not match the value indicated by the radar equipment only in a rare case.   In this case, perform the following procedure to adjust the true bearing value of the radar equipment to the value of the master gyro.

Procedures   1.   **Press the [RADAR MENU] key twice.**

2.   **Open the GYRO Setting menu by performing the following menu operation.**

> 4. NAV Equipment Setting
> → 1. GYRO Setting
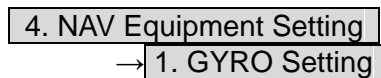
3.   **Input the master gyro value to the value input screen.   (For inputs to the value input screen, refer to Section 3.3.4.)**

4.   **Move the cursor onto the   ENT   button, and press the [ENT] key.**

7.1.8 Antenna Height Setting (Antenna Height)

Set the height of radar antenna above sea level.　Do not change this setting carelessly.

Procedures

1. **Measure the height of radar antenna above sea level in advance.**

2. **Open the Serviceman Menu.**

3. **Open the Antenna Height menu by performing the following menu operation.**

   1. Adjust Menu
   → 4. TXRX Adjustment
   → 1. Antenna Height

4. **Select the setting that matches the antenna height measured in step 1.**

7.1.9 Setting of CCRP/Antenna/GPS Antenna Position (CCRP Setting)

Set the own ship's CCRP location, radar antenna installation location, and GPS installation location.

CCRP : Up to four locations can be input.　(One location selected when used)
Radar antenna : Up to eight radar antennas can be input.　(Automatically selected in response to ISW operation)
GPS : Up to four locations can be input.　(One location selected when used)

Procedures

1. **Measure the CCRP location, radar antenna location, and GPS antenna location in advance.**

2. **Open the Serviceman Menu.**

3. **Open the CCRP Setting menu by performing the following menu operation.**

    2. Installation Menu
    　　　→ 4. CCRP Setting
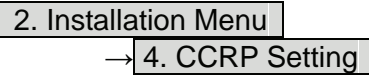
4. **Specify the ship length for Length at the upper right of the CCRP Setting Menu, and the ship width for Beam.**

5. **Move the cursor onto the CCRP1 X, Y value, and press the ENT key to input the CCRP1 location.**

    When $X > 0$, the CCRP is on the starboard side of the ship.　When $X < 0$, it is on the port side.

6. **To input the second CCRP, press the** CCRP2 **button to display the CCRP2 X,Y value, and input the value in the same manner for step 5.**

    Similarly, input the third and subsequent CCRPs.

7. **Repeat the above steps to input the GPS location(s) and radar antenna location(s).**

8. **If multiple CCRP locations and GPS locations are input, select the CCRP location and GPS location to be used by pressing the buttons at the upper left of the menu.**

9. **Press [0] key to close the CCRP Setting menu.**

7

例 :
Example:

5m

RADAR Antenna2
X 5m, Y 250m

GPS1
X -10m, Y 30m

CCRP1
X 0m, Y 25m

Length 300m

250m

30m

15m

10m

25m

Beam 30m

RADAR Antenna1
X 0m, Y 15m

CCRP Setting

Y[m]

Length   300.0 m
Beam   30.0 m

1. Select CCRP   CCRP1
2. Select GPS   GPS1

● GPS
● RADAR Antenna
● CCRP
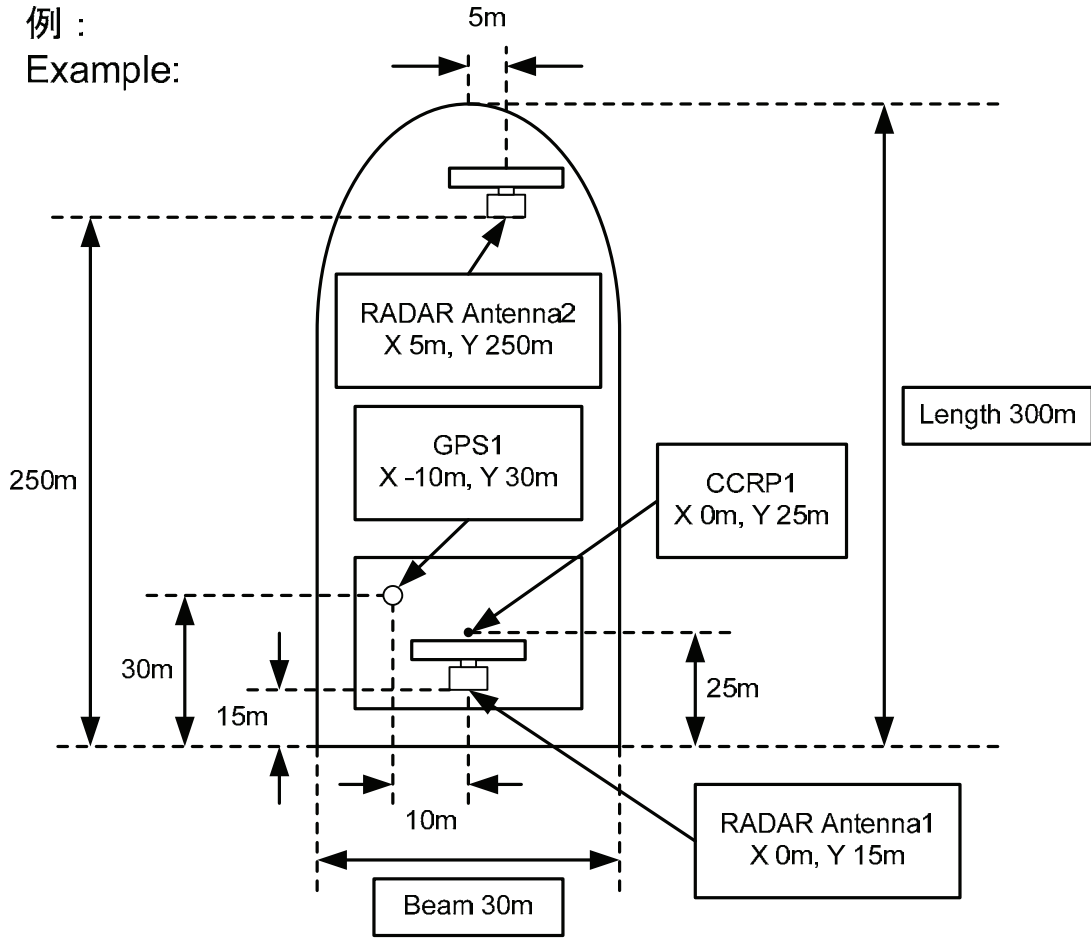
	X	Y	
GPS1	−10.0	30.0	m
GPS2			m
GPS3			m
GPS4			m

	X	Y	
RADAR Antenna1	0.0	15.0	m
RADAR Antenna2	5.0	250.0	m
RADAR Antenna3			m
RADAR Antenna4			m
RADAR Antenna5			m
RADAR Antenna6			m
RADAR Antenna7			m
RADAR Antenna8			m

	X	Y	
CCRP1	0.0	25.0	m
CCRP2			m
CCRP3			m
CCRP4			m

0.   Exit

(0,0)

X[m]

7-9

7.2 SETTINGS

This section describes the electrical adjustment procedures to be performed by service engineers during system installation.

⚠ **CAUTION**

🚫 **Any adjustments must be made by specialized service personnel.**
Incorrect settings may result in unstable operation.

🚫 **Do not make any adjustments during navigation. Failure to comply may result in adverse effects on the radar function which may lead to accidents or equipment failure.**

7.2.1 Communication Port Setting (COM Port Setting)

External sensor signals are input to the radar equipment through a communication port. The radar equipment has five communication ports. For signals to be input from sensors or to be output to the sensors, communication ports need to be set in accordance with the sensors.

7

[I] Baud Rate Setting

Set the baud rate of the signal to be input to the COM port.

Procedures
1. **Open the Serviceman Menu.**

2. **Open the Baud Rate menu by performing the following menu operation.**

2. Installation Menu
→ 5. COM Port Setting
→ 1. Baud Rate

3. Set the baud rate of the port to be set.

Selection value

1. COMPASS	: 4800(NMEA)/9600(NSK)/**38400(Fast NMEA)** bps
2. NAV1	: 1200/**4800**/9600/38400 bps
3. NAV2	: 1200/**4800**/9600/38400 bps
4. GPS	: 1200/**4800**/9600/38400 bps
5. NMEA	: 1200/**4800**/9600/38400/115200 bps

The bold values are factory-set.
The COMPASS port is a receive-only port that is dedicated to COMPASS signals.

[II] Reception Port Setting (RX Port)

Set the numbers of ports for receiving signals from sensors.
There are two methods for receiving signals: specifying a port for each sensor, or using the automatic recognition function without specifying ports.

Procedures

1. Open the Serviceman Menu.

2. Open the RX Port menu by performing the following menu operation.

   2. Installation Menu
   → 5. COM Port Setting
   → 2. RX Port
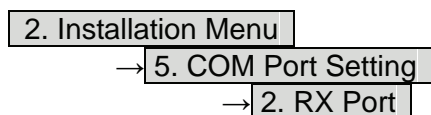
3. Set a port for each sensor.

Settable sensor signals

   GPS, DLOG, Alarm, Depth, Temperature, Wind, Current, ROT, RSA

Selectable ports

   When the automatic recognition function is used: AUTO
   When ports are specified: NAV1, NAV2, GPS, and NMEA

[Ⅲ]Reception Sentence Setting (RX Sentence)

Set signal sentences to be received from sensors.
The system is factory-set for using all sentences.
To receive only specified sentences, select   No Use   for sentences which are not necessary.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the RX Sentence menu by performing the following menu operation.**

   2. Installation Menu
   → 5. COM Port Setting
   → 3. RX Sentence
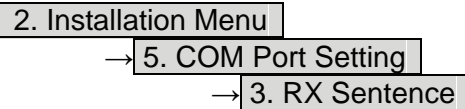
3. **Select the sentences to be used by the sensors to be set.**

   Selection value: Use   or   Not Use   can be selected for each sentence.

1. GPS(LL/COG/SOG) >	: GGA/RMC/RMA/GNS/GLL/VTG
2. GPS(WPT/Time) >	: GGA/RMC/RMB/BWC/BWR/ZDA
3. Depth >	: DPT/DBK/DBT/DBS
4. Wind >	: MWV/MWD
5. Current >	:
Data Set Number	: 0-9. Set the number of the sentence to be used by Data Set Number. (Initial value All)
Layer A	: 0-999. Set the number of the sentence to be used with layer A by Layer Number. (default value : 3)
Layer B	: 0-999. Set the number of the sentence to be used with layer B by Layer Number. (default value : 4)
Layer C	: 0-999. Set the number of the sentence to be used with layer C by Layer Number. (default value : 5)
6. Autopilot >	: APB (default value : Not Use)

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[IV]　Transmission Port Setting (TX Port)

For each sentence, set a communication port through which signals are transmitted to sensors.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the TX Port menu by performing the following menu operation.**

   2. Installation Menu
   → 5. COM Port Setting
   → 4. TX Port
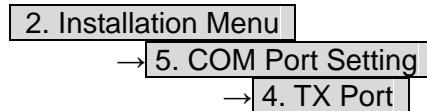
3. **Select the communication port through which the sentence to be set is output.**

   Settable sentences
   TTM(TT), TLL(TT), TTD(TT), TLB(TT), OSD, RSD, ALR, ACK,
   TTM(AIS), TLL(AIS), TTD(AIS), TLB(AIS), RemoteMaintenance,
   JRC-ARPA, APB, BOD, GGA, GLL, RMC, RMB, VTG, XTE,
   BWC, HDT, THS

   Selectable ports
   NAV1, ARPA, GPS, and NMEA

4. **Select the output format, talker, and transmission interval.**

   Signals for which the above items can be set:

   - NMEA0183 Output Format
     Signal names: APB, BOD, GGA, GLL, RMC, RMB,VTG, XTE, BWC, HDT, THS
     Selection Value: V1.5, V2.0, and V2.3

   - NMEA0183 Talker
     Signal names: APB, BOD,RMB, XTE, BWC, HDT, THS
     Selection Value:
     Standard: The talker is RA.
     GP: The talker is GP.
     For TTM, TLL, TTD, TLB, OSD, RSD and ALR the talker is always RA .
     For GGA, GLL, RMC, and VTG, the talker is always GP.

   - NMEA0183 TX Interval
     Signal names: APB, BOD, GGA, GLL, RMC, RMB,VTG, XTE, BWC, HDT, THS
     Selection Value: Set an interval in the range 1 to 9 seconds.

[V] GPS Receive Port Setting (Select NAV Equipment)

Select the receive port of GPS data.

Procedures
    1. Open the Serviceman Menu.

    2. Open the COM Port setting menu by performing the following menu operation.

         2. Installation Menu
                      → 5. COM Port Setting
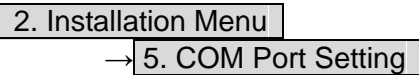
    3. Press the [5] key.

    Units of Select NAV Equipment are switched.

    Internal GPS   : The receive port is selected GPS connector of processor unit
                              (JRC's GPS).
    External GPS   : The receive port is selected GPS terminal of terminal board
                              circuit.

7.2.2   Sector Blank Setting (Sector Blank)

In order not to display radar echoes, set a sector and stop transmission in the bearing.   Three sector blank areas can be created.
The sector blank function operates in the relative bearing with the bow.

[I] Sector Blank Function On/Off (Sectors 1, 2, and 3)

Procedures
    1. Open the Serviceman Menu.

    2. Open the Sector Blank menu by performing the following menu operation.

         2. Installation Menu
                    → 3. Sector Blank
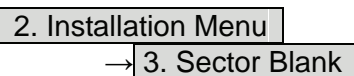
    3. Set the sector blank number Sector 1 , 2 , or 3 with which the sector blank function operates.

    The system allows the use of up to three sector blank areas.
    Set each sector blank area to on or off.
    On : The sector blank function is operated.
    Off : The sector blank function is stopped.

[II] Sector Blank Area Creation (Make Sectors 1, 2, and 3)

Procedures	1. **Transmit the radar.**

2. **Open the Serviceman Menu.**

3. **Open the Sector Blank menu by performing the following menu operation.**

> 2. Installation Menu
> → 3. Sector Blank
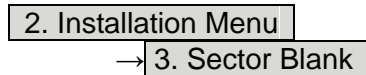
4. **Press numeric keys corresponding to the desired sector creation**
   Make Sector 1 , 2 , or 3 .

   The selected sector blank will be made.

5. **Set the starting bearing of the sector blank by operating the [EBL] dial, and press the [ENT] key.**

6. **Set the ending azimuth of the sector blank by operating the [EBL] dial, and press the [ENT] key.**

7.2.3   TNI Blank Setting (TNI Blank)

Set a sector and stop tuning operation in the bearing.
If a structure such as the mast is close to the radar antenna, automatic tuning operation may become unstable.   In this case, set a TNI blank in the direction of the structure in order to stabilize the tuning operation.
Only one TNI blank sector can be created.   The TNI blank function operates in the relative bearing with the bow as the benchmark.

[I] TNI Blank Function On/Off (Sector)

Procedures	1. **Open the Serviceman Menu.**

2. **Open the TNI Blank menu by performing the following menu operation.**

> 2. Installation Menu
> → 9. Next
> → 2. TNI Blank
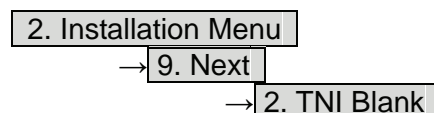
3. **Select the item   1. TNI Blank   in the menu, and turn on or off the TNI blank function.**

   On : The TNI blank function is operated.
   Off : The TNI blank function is stopped.

[II] TNI Blank Area Creation (Make Sector)

Procedures   1. **Transmit the radar.**

2. **Open the Serviceman Menu.**

3. **Open the TNI Blank menu by performing the following menu operation.**

   2. Installation Menu
      → 9. Next
          → 2. TNI Blank
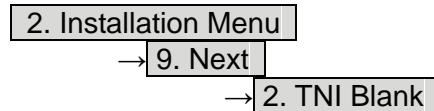
4. **Press the   2. Make Sector   button in the menu.**

5. **Set the starting bearing of the TNI blank by operating the [EBL] dial, and press the [ENT] key.**

6. **Set the ending bearing of the TNI blank by operating the [EBL] dial, and press the [ENT] key.**

7.2.4   Setting of Bearing Pulses from Antenna (Output Pulse)

Set the output value of bearing pulses from the antenna.   The system can set 2048 pulses or 4096 pulses.

Procedures   1. **Open the Serviceman Menu.**

2. **Open the Output Pulse menu by performing the following menu operation.**

   1. Adjust Menu
      → 4. TXRX Adjustment
          → 6. Output Pulse
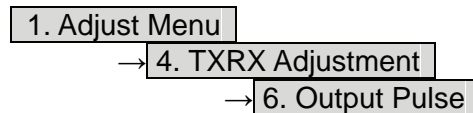
3. **Set the number of pulses to be output by the antenna.**

   2048 : 2048 pulses per antenna rotation (Recommended value)
   4096 : 4096 pulses per antenna rotation

7

7.2.5　Slave Mode Setting (Master/Slave)

Place the system in the ⎡Slave⎤ mode when it is to be operated as the sub-display that displays radar echoes by using radar signals from other radar equipment.
The input value of externally input bearing pulses can be set.　The system can set 2048 pulses or 4096 pulses.

[I]　Slave Mode Setting (Master/Slave)

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Installation Menu by performing the following menu operation.**

   ⎡2. Installation Menu⎤

3. **Select Slave for the item ⎡2. Master/Slave⎤ in the menu.**

   ⎡Master⎤ : The system operates as radar equipment while the own antenna is connected.
   ⎡Slave⎤ : The system operates as a sub-display while the signal cable of other radar equipment is connected.

[II] Setting of Input Bearing Pulse (Input BP Count)

Procedures

1. **Open the Serviceman Menu.**

2. **Open the second page of the Installation Menu by performing the following menu operation.**

   ⎡2. Installation Menu⎤
   →⎡9. Next⎤

3. **Set the number of pulses for the item ⎡1. Input BP Count⎤ in the menu.**

   ⎡2048⎤ : 2048 pulses per antenna rotation
   ⎡4096⎤ : 4096 pulses per antenna rotation

7.2.6   Language Setting (Language)

The system is designed to switch between display languages, English and Japanese.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Language menu by performing the following menu operation.**

   2. Installation Menu
   → 8. Language

3. **Select the language to be used.**

   1. English
   2. Japanese
   3. Other

   3. Other   is an option to display character strings created by our agents.
   Ask the agent or our sales department if your language is supported.

4. **To determine the selected language, turn the radar off, and then turn it on.**

7.2.7   Date Time Setting

To display time, the local time, local date, and time-zone difference must be set.
However, if the "ZDA" sentence of NMEA0183 is received, time can be automatically displayed.

7

Procedures

1. **Press the [RADAR MENU] key twice.**

2. **Open the Date/Time Setting menu by performing the following menu operation.**

   5. Sub Menu
   → 6. Date/Time Setting

2. Set information about date and time.

[1] UTC/LMT (Time display system)

| UTC | : Universal Time Coordinate |
| LMT | : Local Mean Time |

[2] LMT Date
Input the date in local time.

[3] LMT Time
Input the time in local time.

[4] Time Zone
Input the time-zone difference between the universal time and local time.

[5] Display Style
Set one of the following date display formats.

YYYY-MM-DD	: Example: 2007-12-31
MMM DD, YYYY	: Example: Dec 31, 2007
DD MMM YYYY	: Example: 31 Dec 2007

[6] Synchronize with GPS
A ZDA sentence sent by the GPS is used, thereby displaying time synchronized with the GPS time.

| On | : Time synchronized with the GPS time |
| Off | : Time not synchronized with the GPS time |

* If On is selected for this item but a ZDA sentence is not input, the system internal clock function is used to display the date and time.

7.2.8   Input Installation Information

The system can input installation information.

Procedures

1. Open the Serviceman Menu.

2. Open the Installation Information menu by performing the following menu operation.

 2. Installation Menu
   → 1. Installation Information

3. Input the installation information.

For the input method on the numeric value and character input screens, see Section 3.3.4.

[1] Date
Input the date of installed system.

[2] Name
Input the name of installation personel.

[3] Company
Input the name of radar installer.

7.2.9   Setting the Alarm System

Setting the relay output (Relay Output)

This function enables the control of ARPAALM terminal (on the terminal board circuit).

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Relay Output menu by performing the following menu operation.**

   2. Installation Menu
   → 6. Alarm System
   → 2. Relay Output
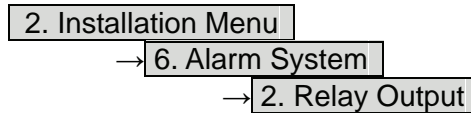
3. **Press the [1] key.**

   The Relay Output mode is switched.

   | Continuous | : The output is continuously controlled. |
   | Intermittent | : The output is intermittenly controlled. |

4. **Press the [numeric] key corresponding to the item to be changed.**

   The item can be turned on / off.
   | On | : The relay output is turned on when alarm have issued. |
   | Off | : The relay output is not turned on when alarm have issued. |

2. TT CPA/TCPA	: There is a dangerous target. (tracked target)
3. AIS CPA/TCPA	: There is a dangerous target. (AIS target)
4. New Target	: A new target is acquired in the automatic acquisition zone.
5. Lost	: There is a lost target. (Target Tracking / AIS).
6. RADAR Alarm	: Targets have entered the radar alarm range.

Setting the ALR output (ALR Output)

This function enables the control of ALR port (See the section 7.2.1).

Procedures

1. **Open the Serviceman Menu.**

2. **Open theALR output menu by performing the following menu operation.**

   2. Installation Menu
   → 6. Alarm System
   → 3. ALR Output
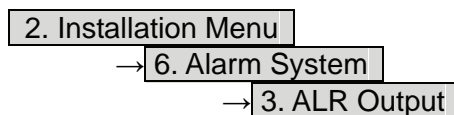
3. **Press the [numeric] key corresponding to the item to be changed.**

   The item is turned on / off.
   | On | : The ALR sentence is output when alarm have issued. |
   | Off | : The ALR sentence is not output when alarm have issued. |

   | 1. System Alarm | : The internal alarm. |
   | 2. TT/AIS Alarm | : Target Tracking Alarms and AIS Function Alarms. |

Setting the External Acknowledgement (External ACK Setting)

This function enables the control of system when ACK sentence have received.

1. Open the Serviceman Menu.

2. Open the External ACK Setting menu by performing the following menu operation.

> 2. Installation Menu
> → 6. Alarm System
> → 5. External ACK Setting
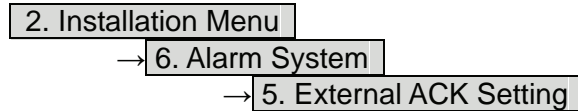
3. Press the [numeric] key corresponding to the menu to be changed.

| Critical Alarm | : CPA/TCPA alarm. |
| Normal Alarm | : Exept Critical Alarm. |

4. Press the [numeric] key corresponding to the item to be changed.

The item is switched.

Audio : Setting of alarm sound.
    On : The alarm sound is not stopped when acknowridgement have received.
    Off : The alarm sound is stopped when acknowridgement have received.

Indication : Setting of alarm indication.
    Lighting : The alarm indication brinking is stopped when acknowridgement have received.
    Brinking : The alarm indication brinking is not stopped when acknowridgement have received.

Acknowridge State : Setting of ALR sentence.
    A:ACK : Add acknowridgement to ALR sentence.
    V:UNACK : Add no acknowridgement (unrecognized) to ALR sentence.

7.3 ADJUSTMENT

This section describes the electrical adjustment procedures to be performed by service engineers during system installation.

⚠ **CAUTION**

🚫 **Any adjustments must be made by specialized service personnel.**
Incorrect settings may result in unstable operation.

🚫 **Do not make any adjustments during navigation. Failure to comply may result in adverse effects on the radar function which may lead to accidents or equipment failure.**

7.3.1 Noise Level Adjustment (Noise Level)

[I] Noise Level Adjustment for Signal Processing

7

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Echo Noise Level menu by performing the following menu operation.**

   9. SP/TT Initial Setup
   → 1. Signal Processing
   → 1. Echo Noise Level
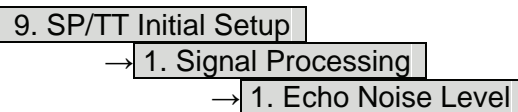
3. **Increase/decrease the noise level adjustment value.**

   The noise level is factory-set.
   After system installation, a great change in the noise level adjustment value should be avoided; it should be fine adjusted within ±5.

[II] Noise Level Adjustment Mode (Setting Mode)

A noise level is factory-adjusted while this mode is turned on.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Signal Processing menu by performing the following menu operation.**

   9. SP/TT Initial Setup
       → 1. Signal Processing

3. **Press the [2] key.**

   The noise level setting mode is switched between on and off.

   Factory-adjustment method

   - The GAIN control is set to the maximum position, the SEA control is set to the minimum position, the RAIN control is set to the minimum position, and IR, AUTO-SEA, AUTO-RAIN, PROC, FUNC, and TRAILS are all set to off.
   - The noise level adjustment mode is turned on.
   - While the noise level adjustment value is decreased gradually, the value with which radar echoes no longer appear is determined as the set value.
   - Ten is added to the set value (with which radar echoes no longer appear), and the result is set as the final noise level adjustment value.
   - The noise level adjustment mode is turned off when the adjustment is finished.

7.3.2 Adjustment of Target Tracking Function (TT)

⚠ **CAUTION**

🚫 **Optimal values have been set for Video Level and Vector Constant; therefore, never change their values unless absolutely necessary. Failure to comply may result in accidents that would lower target tracking performance.**

[I] Vector Constant Adjustment (Vector Constant)

Adjust the vector follow-up performance of the target tracking function.
The vector constant is adjusted to an optimal value, so do not change it carelessly.

──── Attention ────

● **Do not change the set value carelessly.**

The vector constant shall be set to 4 normally. If the vector constant value is higher, a target's vector will be better followed up when the target and own ship change their course or speed, but the vector accuracy will be lower on the contrary.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Vector Constant menu by performing the following menu operation.**

   9. SP/TT Initial Setup
   → 2. TT
   → 1. Vector Constant

3. **Input the value to be set.**

   To improve vector follow-up performance, increase the set value.
   To stabilize vectors, decrease the set value.

[II] Quantization Level Adjustment (Video Level)

Use the target tracking function (TT) to adjust the level of the signal to be recognized as a target.   If a small value is set, even weak target signals will be input to the target detection circuit of the target tracking function.   However, many unnecessary signals are also input, which may cause unstable target acquisition or tracking.   It is important to set a value four or five greater than the value with which unnecessary signals are detected.
The quantization level is adjusted to an optimal value, so do not change it carelessly.

⚠ CAUTION

🚫 **Do not change the quantization level settings unless absolutely necessary.   If set at an inappropriate value, the target acquisition or target tracking function deteriorates, and this may lead to accidents.**

Procedures

1. **Open the Serviceman Menu.**

2. **Open the TT (Target Tracking) menu by performing the following menu operation.**

   | 9. SP/TT Initial Setup |
   → | 2. TT |

3. **To change the quantization level of the automatic acquisition area, specify the item | 2. Video TD Level | in the menu.   To change the quantization level of tracking and manual acquisition, specify the item | 3. Video High Level |.**

[III] Gate Size Adjustment (Gate Size)

Use the target tracking function (TT) to set a target search area.
The gate size is adjusted to an optimal value, so do not change it carelessly.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Gate Size menu by performing the following menu operation.**

   9. SP/TT Initial Setup
   → 2. TT
   → 5. Gate Size
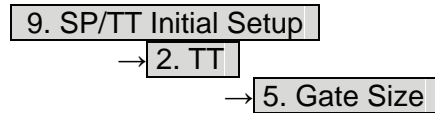
3. **Select a gate size.**

   Wide   : Large gate size
   Normal   : Medium gate size
   Narrow : Small gate size

[IV]   CPA Limit Ring Display On/Off (Limit Ring)

Use the target tracking function (TT) to determine whether to display the CPA limit for determining a dangerous ship.   When the CPA limit ring display function is turned on and a relative vector is used, the CPA limit ring is displayed as a red circle.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the TT (Target Tracking) menu by performing the following menu operation.**

   9. SP/TT Initial Setup
   → 2. TT
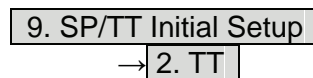
3. **Press the [6] key.**

   The Limit Ring item is turned on / off.
   Off   : Limit ring not displayed
   On   : Limit ring displayed

7

7.3.3   Main Bang Suppression Adjustment (MBS)

Main Bang Suppression is adjusted to suppress main bang, a reflection signal from 3D circuit including wave guide tube, that generally appears as a circular video focusing on the center of the radar display. Optimum adjustment allows main bang video to remain slightly on the display.

> ⚠ # WARNING
>
> 🚫 **Do not change MBS Level/Area unless absolutely necessary.**
> **Incorrect adjustment will result in deletion of nearby target images and thus collisions may occur resulting in death or serious injuries.**

Procedures

1. **Open the Serviceman Menu.**

2. **Open the MBS menu by performing the following menu operation.**

   | 9. SP/TT Initial Setup |
   → | 3. MBS |

3. **Set the radar as follows:**

   - Set the radar video enhance function and video processing (PROC) to OFF.
   - Turn the [RAIN] control to the minimum position (fully to the left).
   - Turn the [GAIN] control to the maximum position (fully to the right).
   - Turn the [SEA] control to achieve the strength with which main bang can be judged.

4. **Set 20 for | 2. MBS Area | .**

5. **Adjust the value set for | 1. MBS Level | so that the main bang remains slightly.**

6. **Adjust the value set for | 2. MBS Area | so that the suppression area will match the main bang.**

7.4 MAINTENANCE MENU

This item is provided for equipment maintenance, including settings of antenna safety switch, master reset, etc.

⚠ CAUTION

🚫	**Any adjustments must be made by specialized service personnel.** **Failure to comply may result in accidents or equipment failure.**
🚫	**Do not make any adjustments during navigation. Failure to comply may result in adverse effects on the radar function which may lead to accidents or equipment failure.**

7.4.1 Antenna Safety Switch (Safety Switch)

Use this switch to measure the transmission/reception performance while the antenna is in stopped state.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Safety Switch menu by performing the following menu operation.**

   | 3. Maintenance Menu |
   → | 1. Safety Switch |

3. **Select the item to be set.**

   Set operation when the antenna safety switch is turned off.

   | 1. TX-Off | :
      The transmitter stops transmission.
      The display unist remains in transmission state.
   | 2. Standby | : (Normal setting)
      The transmitter stops transmission.
      The display unit is placed in standby state.
   | 3.TX-On | :
      The transmitter continues transmission.
      The display unit remains in transmission state.

4. **Change the setting back to | 2. Standby | when the work is finished.**

7.4.2 Initialization of Memory Area (Area Initial)

If system operation is unstable, it may be stabilized by initializing the memory area. To initialize the memory area, follow the procedure in this section. The memory area is reset to the factory setting when initialized.

[I] Partial Master Reset

`Procedures`   1. **Open the Serviceman Menu.**

2. **Open the Partial Master Rest menu by performing the following menu operation.**

> 3. Maintenance Menu
> → 2. Area Initial
> → 1. Partial Master Reset
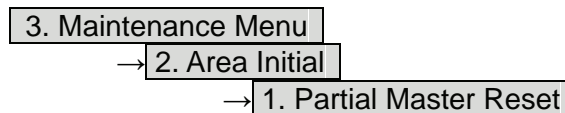
3. **Select the items to be initialized.**

Serviceman Menu	: The set values in the Serviceman menu are initialized.
Except Serviceman Menu	: The set values not in the Serviceman menu are initialized.
User Setting	: The user setting values are initialized.
TT Setting	: The set values for the target tracking function are initialized.
AIS Setting	: The set values for the AIS function are initialized.
Day/Night	: The color scheme and brilliance setting for the day/night mode are initialized.
JRC Card Copy Record	: The history of JRC charts copied on the memory card is erased.

4. **Select** `Yes` **in the Confirmation Window.**

The memory areas of specified items are initialized, and the system is restarted.

[II] All Master Reset

`Procedures`   1. **Open the Serviceman Menu.**

2. **Open the All Master Rest menu by performing the following menu operation.**

> 3. Maintenance Menu
> → 2. Area Initial
> → 2. All Master Reset
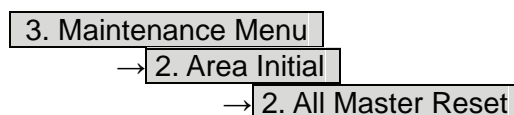
3. **Select** `Yes` **in the Confirmation Window.**

The whole memory area is initialized, and the system is restarted.

7.4.3 Save of Internal Memory Data (Card1/2)

The system can save internal memory data such as item settings in all menus onto a flash memory card.   If the radar processing circuit in the system has been replaced, the set values before the circuit replacement can be restored by reading the set values you saved before the replacement.
To save the internal memory data onto a flash memory card (option), the card must be inserted in card slot beforehand.

[I] Copying of Internal Settings onto Card (Internal to Card1/2)

Save the internal memory data, such as item settings in menus, onto a flash memory card.
The internal memory data should be saved at completion of system setting, and the operation condition should be saved periodically.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Internal to Card 1/2 menu by performing the following menu operation.**

   3. Maintenance Menu
   → 3. Internal to Card1/2
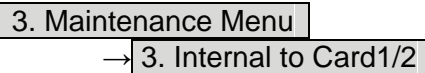
3. **Select the slot of the card on which the internal memory data is to be saved.**

   The lower slot is slot 1; the upper slot is slot 2.

4. **Select** Yes **in the Confirmation Window.**

   The internal memory data is saved on the flash memory card.

[II] Reading of Internal Settings from Card (Card1/2 to Internal)

Read the saved memory data from the flash memory card into the system memory.
Perform the read operation in order to return the system to the previous operation condition after replacement of the radar processing circuit in the system.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Card 1/2 to Internal menu by performing the following menu operation.**

   3. Maintenance Menu
   → 4. Card1/2 to Internal
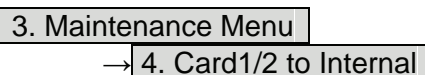
3 **Select the slot of the card from which the previously saved internal memory data is to be read.**

   The lower slot is slot 1; the upper slot is slot 2.

4. **Select** Yes **in the Confirmation Window.**

   The memory data is read from the flash memory card into the system memory.
   After the internal memory area is updated, the system is restarted.

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7.4.4 Clear and Save/Restoration of Antenna Operation Time (TXRX Time)

The system adds up the following operation time and contains it in the antenna unit:
- Transmission time
- Motor run time

Clear the above total time when the magnetron or antenna unit motor is replaced.

[I] Clear of Transmission Time (Clear TX Time)

Clear the transmission time of the antenna unit.
Perform the following procedure to clear the transmission time when the magnetron is replaced.

Procedures

1. **Open the Serviceman Menu.**

2. **Open the Clear TX Time menu by performing the following menu operation.**

   3. Maintenance Menu
   → 5. TXRX Time
   → 1. Clear TX Time
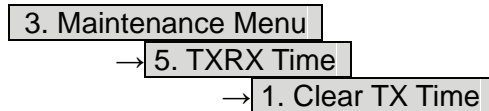
3. **Select Yes in the Confirmation Window.**

   The transmission time in the antenna's internal control circuit is cleared to 0.

[II] Clear of Motor Run Time (Clear Motor Time)

The Clear Motor Time Function is unavailable in The JMA-5352-9R and JMA-5362-8R.

[III] Save of Antenna Time (TXRX to Display Unit)

The TXRX to Display Unit Function is unavailable in The JMA-5352-9R and JMA-5362-8R.

[IV] Restoration of Antenna Time (Display Unit to TXRX)

The Display Unit to TXRX Function is unavailable in The JMA-5352-9R and JMA-5362-8R.

7.4.5 Update of Character String Data (String Data Update)

The system is designed to transfer and display external character strings as the second language display.
The second language is factory-set to "Japanese."
Ask our agent or sales department for the supply of character strings to be updated.
To update character strings, the flash memory card (option) containing the character string file must be inserted in card slot 2.

Procedures   1. **Open the Serviceman Menu.**

2. **Open the String Data Update menu by performing the following menu operation.**

    | 3. Maintenance Menu |
    → | 6. String Data Update |

3. **Select Yes in the Confirmation Window.**

    The character string file on the flash memory card is read into the system, and the second language area is updated.
    To display the read character strings in the second language, select Other in the menu shown in Section 7.2.6.

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SECTION 8
MAINTENANCE

8.1 ROUTINE MAINTENANCE

⚠ DANGER

🚫 **Never carry out internal inspection or repair work of the equipment by users.**
Inspection or repair work by uncertified personnel may result in fire hazard or electrocution.
For inspection and repair work of equipment components, consult with our branch office, branch shop, sales office, or our distributor in your district.

❗ **When conducting maintenance, make sure to turn the main power off.**
Failure to comply may result in electrocution.

❗ **Turn off the main power before cleaning the equipment. Especially when a rectifier is used, make sure to turn it off since voltage is still outputted from the rectifier even after the indicator and the radar are turned off.   Failure to comply may result in equipment failure, or death or serious injury due to electric shock.**

For operating the radar equipment in the good conditions, it is necessary to make the maintenance work as described below.   If maintenance is made properly, troubles will reduce.   It is recommended to make regular maintenance work.
Common points of maintenance for each unit are as follow:

Clean the equipment.

Remove the dust, dirt, and sea water rest on the equipment cabinet with a piece of dry cloth.
Especially, clean the air vents with a brush for good ventilation.

8.2   MAINTENANCE ON EACH UNIT

8.2.1   Scanner Unit NKE-1064/3710-8

⚠ **DANGER**

❗	**When conducting maintenance work on the scanner, make sure to turn its main power off.** **Failure to comply may result in electrocution or injuries.**
❗	**Make sure to turn off the scanner safety switch. Failure to comply may result in injuries caused by physical contact with the rotating scanner.**
❗	**Do not touch the radiator. Even if the power is turned off, the radiator may be rotated by the wind.**

After the work, turn "ON" the scanner unit safety switch.

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Precautions in Mounting the Cover

When the cover is removed for regular checkup and replacement of parts and refitted after such work, the procedures of fastening bolts shall be taken with the following precautions:

 (a) The proper fastening torque of the fitting bolts (M8) is 1176 to 1470 N-cm (120 to 150 kgf-cm) (which makes the inside water-tight and protects the packing against permanent compressive strain).
    The packing start producing from the cover at a torque of approximately 1470 N-cm (150 kgf-cm).
    Do not fasten the bolts with a torque exceeding the specified value.   Otherwise, the screws may be broken.
 (b) Use an offset wrench of 11 mm × 13 mm or a double-ended wrench of 13 mm × 17 mm (not longer than 200 mm).
 (c) Screw all the bolts by hand first to prevent them playing, then fasten them evenly in order not to cause one-sided fastening.   (Fasten the bolts with 25% of the required torque at the first step.)

    *: Fasten the bolts in the diagonal order.
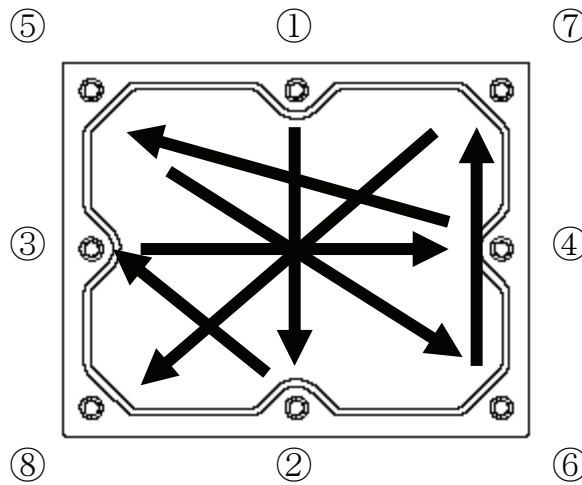
Side View of NKE-1064
Bolt Tightening Procedure of NKE-1064 Cover
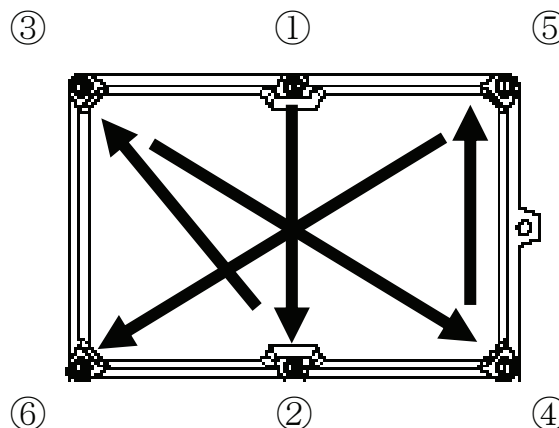
Side View of NKE-3710-8
Bolt Tightening Procedure of NKE-3710-8 Cover

8-3

(1) Radiator

Attention

- **If the radiator front face (radiation plane) is soiled with smoke, salt, dust, paint or birds' droppings, wipe it with a piece of soft cloth wetted with alcohol or water and try to keep it clean at all times. Otherwise, radar beam radiation may attenuate or reflect on it, resulting in deterioration of radar performance.**
- **Never use solvents of gasoline, benzine, trichloroethylene and ketone for cleaning.**

Check up and clean the radiator.

(2) Rotating section

   (a)   Supply Oil Seal
   An scanner unit with a grease nipple needs grease supply. Remove the cap of the grease nipple on the front of the radiator support, and supply grease with a grease gun.
   Make the oiling every six months. The oil quantity shall be approximately 100 g, which is as much as the grease comes out of the oil seal. Use the grease of Mobilux 2 of Mobil Oil.

   (b)   Oiling gears
   Apply grease evenly to the tooth surfaces of the main shaft drive gear and the encoder drive gear with a spreader or brush. Oiling in short intervals is more effective to prevent the gears from wear and tear and extend their service life, but oil at least every six months.
   Use Mobilux2 of Mobile Oil.

   (c)   Mounting legs
   Check the mounting legs and mounting bolts of the scanner unit case for corrosion at intervals and maintain them to prevent danger. Apply paint to them once a half year because painting is the best measure against corrosion.

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8.2.2 Display Unit NCD-4530

⚠ WARNING

🚫 **When cleaning the display screen, do not wipe it too strongly with a dry cloth.   Also, do not use gasoline or thinner to clean the screen.   Failure to comply will result in damage to the screen surface.**

Dust accumulated on the screen will reduce clarity and darken the video.   For cleaning it, wipe it with a piece of soft cloth (flannel or cotton).   Do not wipe it strongly with a piece of dry cloth nor use gasoline or thinner.

8.3   PERFORMANCE CHECK

Make operational check on the radar equipment regularly and if any problem is found, investigate it immediately.   Pay special attention to the high voltage sections in checking and take full care that no trouble is caused by any error or carelessness in measurement.   Take note of the results of checking, which can be used effectively in the next check work.
Operational check shall be made in accordance with Table 8-1 Function Check List in the order as specified in it.

Table 8-1   Check List

Equipment	Item to be checked	Criteria	Remarks
Transmitter-receiver Unit (NKE-1064)	Tuning LED of Receiver	The LED is lighting during operation	48NM range
Display Unit	Video and echoes on the screen Sensitivity LCD brilliance can be controlled correctly Various markers Various numerical indications Lighting	Can be correctly controlled	
	Memory	See section 8.3.1 [I]-[1].	
	Communications Lines	See section 8.3.1 [I]-[3].	
	Power Supply, Backup Battery	See section 8.3.1 [I]-[4].	
	Monitor	See section 8.3.1 [II].	
	Operation Unit	See section 8.3.1 [III].	
	System Alarm Log Display	See section 8.3.1 [V].	
	System Information Display	See section 8.3.1 [VI].	
	Magnetron current	See section 8.3.1 [VII].	
	Target Tracking	See section 5.2.7.	
Scanner Unit	Signals from the Scanner Unit	See section 8.3.1 [I]-[2].	

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8.3.1 Check Performance on Test Menu

The radar operating state can be checked by opening the Test Menu.

1. **Perform the following menu open procedure to open the Test Menu.**

> Main
> → 9. NEXT
> → 9. Test Menu
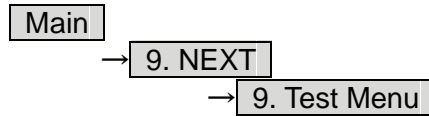
2. **Select the items to be checked.**

The list of check items will appear.

1. Self Test	[I] Self-diagnostic function
2. Monitor Test	[II] Monitor check
3. Keyboard Test	[III] Operation unit check
4. MON Display	[IV] Performance monitor
5. System Alarm Log	[V] Error log display
6. System Information	[VI] System information display
Magnetron Current	[VII] Indication of magnetron current

3. **Select the items to be checked.**

The list of check items will appear.

[I] Self-diagnosis function (Self Test)

Check of memory, scanner unit, and communications Lines

1. Memory Test	[1] Memory check
2. TXRX Test	[2] Scanner check
3. Line Test	[3] Communication line check
4. Supply Voltage	[4] Supply voltage check

[1] Memory Test

Checks for the performance of built-in memory.

1. SDRAM	[1] SDRAM check
2. SRAM	[2] SRAM check
3. FLASH ROM	[3] Flash ROM check
4. GRAPHIC	[4] Graphic check

When no abnormality is found, OK is displayed.
When an abnormality is found, NG is displayed.

[2] TXRX Test

Checks for signals from the scanner.

Safety Switch	Scanner's safety switch check
AZI Pulse	Scanner rotation signal check
HL Pulse	Heading line signal check
MH Current	Check on the load current of high voltage in the modulator
Trigger	Radar trigger signal check
Video	Radar video check

When no abnormality is found, OK is displayed.
When an abnormality is found, NG is displayed.
In standby, ** will appear.

[3] Check of Communication Lines (Line Test)

Check the status of communications with options.

TXRX	Check on connection with the transmitter-receiver
SIG.PROC	Check on connection with the signal processing circuit
TT	Check on connection with the target tracking unit
GYROO I/F	Check on connection with the GYRO I/F unit
GPS Compass	Check on connection with the GPS compass
ISW	Check on connection with the interswitch
Plotter Key	Check on connection with the plotter option

When no abnormality is found, OK is displayed.
When an abnormality is found, NG is displayed.
The status display field of equipment not connected is left blank.

[4] Supply Voltage

Check the voltage of internal power supply.

Item	Normal value
12V	11.00-12.20 V
5V	4.75-5.25 V
3.3V	3.14-3.46 V
Battery	2.50V or more

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[II]   Monitor Test

Checks for the display.
The test pattern will be shown on the display.

Pattern 1	All colors are filled with white.
Pattern 2	A white box is displayed on the black background of 1280×1024 dots.
Pattern 3	Displays rectangle $\times$ 2, circle $\times$ 2, and cross-shape $\times$ 13 (white lines on the black background).
Pattern 4	Displays "H" of 9 dots $\times$ 9 dots on the entire screen (white character on the black background).
Pattern 5	Gray scale display (16 levels)
Pattern 6	Displays a color bar.
Pattern 7	Displays the VDR test pattern.
Pattern 8	Displays the specified color.

To return to the normal display, press any key.
If errors occur in the monitor, no test pattern will appear.

[III]   Keyboard Test (Operation Unit Test)

Checks for the controls and switches of the operation panel.

1. Key Test	[1] Key check
2. Buzzer Test	[2] Buzzer check
3. Light	[3] Control panel light check

[1]   Key Test

Checks for the controls and switches of the operation panel.
Each key on the operation panel on the display is shown in reverse video at the same time the key is pressed, and the name of the pressed key is displayed.

[2]   Buzzer Test

Checks for the operation panel buzzer.
The buzzer will sound.
The buzzer automatically stops after it sounds for a specified length of time.

[3]   Light Test

Checks for the control panel light.
The brightness of the operation panel is gradually intensified at four levels.

[V]   System Alarm Log display

Displays previously occurred system alarms with the dates and times when they occurred.

The Alarm log display button (2-29P Alarm) is clicked, in the same way as that one.

To display the occurrence alarm , press the
1. Display Only Occurrence   button.
To erase the alarm logs, press the   2. All Clear   button.

```
System Alarm Log(UTC)   ▼
PROC(Video)
2008-08-21 01:15
PROC(Trigger)
2008-08-21 01:15
PROC(Video)
2008-08-21 01:15
PROC(Interrupt)
2008-08-21 01:15
PROC(Interrupt)
2008-08-18 10:00
PROC(Video)
2008-08-18 00:42
PROC(Video)
2008-08-18 00:41
TXRX(Data)
2008-08-07 00:04
TXRX(Data)
2008-08-07 00:03
1. Display Only Occurrence
2. All Clear    3.  Next
0.          Exit
```

The current alarm is displayed at the lower right of the radar display.   For details, refer to Chapter 9.

No Alarm

[VI]   System INFO

Displays the current system information.

Indicator	Processor software version information
TXRX	Scanner software version information
System No.	System number
TX Time	Total magnetron transmitting time (Total time during which radar was transmitted)

X-Band	
S-Band	
Motor Time	The Motor Time function is unavailable in The JMA-5352-9R and JMA-5362-8R. "0 hours" is always displayed.
TXRX Total Time	Total operating time of the scanner unit (Total power-on time of the antenna unit)
Total Time	Total operating time of the display unit (Total power-on time of the display unit)

JMA-5352-9R and JMA-5362-8R not display "Motor Time".

[VII]   Magnetron Current

Displays the Magnetron Current bar indicating the magnetron current to check.
When a 48 NM range is set, the magnetron current is normal if the Magnetron Current bar reads the value below.

    JMA-5352-9R   50 kW: 2-4 scale marks
    JMA-5362-8R   60 kW: 4-6 scale marks

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8.4 REPLACEMENT OF MAJOR PARTS

The system includes parts that need periodic replacement.   The parts should be replaced as scheduled. Use of parts over their service life can cause a system failure.

⚠ WARNING

! **Direct exposure to electromagnetic waves at close range will have adverse effects on the human body.   When it is necessary to get close to the scanner for maintenance or inspection purposes, make sure to turn the indicator power switch to "OFF" or "STBY."**

Direct exposure to electromagnetic waves at close range will have adverse effects on the human body.

! **When conducting maintenance work, make sure to turn off the power and unplug the power connector J1 of the radar process unit so that the power supply to the equipment is completely cut off.**

Some equipment components can carry electrical current even after the power switch is turned off, and conducting maintenance work without unplugging the power connector may result in electrocution, equipment failure, or accidents.

⚠ CAUTION

! **Make sure to shut off the main power before replacing parts.   Failure to comply may result in electrocution or equipment failure.**

! **When replacing magnetrons, make sure to shut off the main power and let the equipment stand for more than 5 minutes to discharge the high-voltage circuit.   Failure to comply may result in electrocution.**

⚠ CAUTION

❗	**Make sure to take off your watch when your hand must get close to the magnetron.** **Failure to comply may result in damage to the watch since the magnetron is a strong magnet.**
❗	**Make sure that two or more staff member work together when replacing the LCD. If only one person attempts to replace the LCD, he/she may drop it and become injured.**
🚫	**Do not directly touch the inverter circuit of the LCD display with a bare hand since high voltage temporarily remains in the circuit even after the main power is shut off.** **Failure to comply may result in electrocution.**

8.4.1 Parts Required for Periodic Replacement

Here are parts required for periodic replacement

Part name		Interval	Radar model	Part type	Part code
1. Magnetron		4000 hours	JMA-5352-9R	2J55[i]	5VMAA00113
			JMA-5362-8R	M1461[i]	5VMAA00108
2. Motor		10000 hours	JMA-5352-9R	MPEM30217*	MPEM30217*
			JMA-5362-8R	MPEM00259B*	MPEM00259B*
3. Fan (Scanner Unit)	B201	20000 hours	JMA-5352-9R	109L0924H402	5BFAB00422
	B103			9G1224H102	5BFAB00532
	B201		JMA-5362-8R	9G1224H102	5BFAB00532
4. Fan (power Unit)		20000 hours		109P0424H302	5BFAB00194
5. LCD PANEL		50000 hours		H-CML-771	H-CML-771
6. Monitor fan		20000 hours		H-CBP-173A	H-CBP-173A
7. Fan (Radar Process Unit)		20000 hours		H-7BFRD0005*	H-7BFRD0005*
8. Backup battery		5 years		CR2032	5ZBCJ00012

"*" means revision, such as A, B and so on.
[i]   Use a genuine magnetron.

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8.4.2 Replacement of Magnetron

Caution: Replacement of magnetron must be made by specialized service personnel.
For details, refer to Service Manual.
Use genuine parts as mentioned above.

When mounting a new magnetron, do not touch the magnet with a screwdriver or put it on an iron plate.
After replacement, connect the lead wire correctly.

Handling of Magnetron under Long-Time Storage

The magnetron that has been kept in storage for a long time may cause sparks and operate unstably when its operation is started.   Perform the aging in the following procedures:

(1) Warm up the cathode for a longer time than usually.   (20 to 30 minutes in the STBY state.)
(2) Start the operation from the short pulse range and shift it gradually to the longer pulse ranges.   If the operation becomes unstable during this process, return it to the standby mode immediately.   Keep the state for 5 to 10 minutes until the operation is restarted.

Magnetron Replacement Procedure for Scanner Unit NKE-1064

Before starting part replacement work, turn off the safety switch of the scanner unit.

1) Turn off the safety switch.
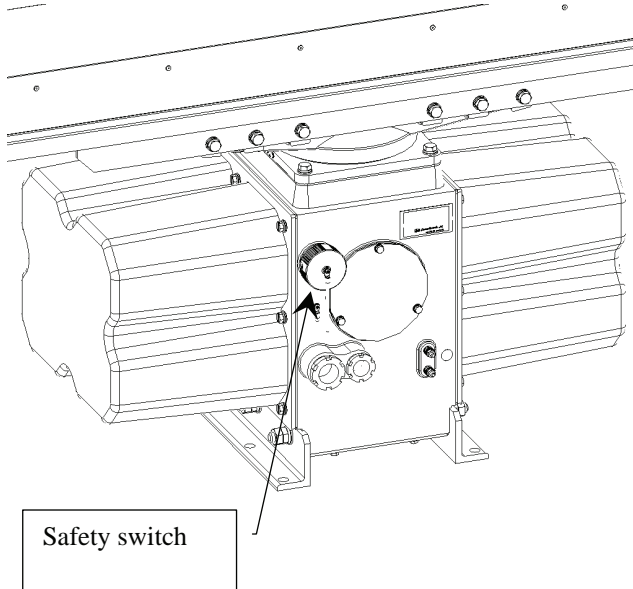
The safety switch is located on the rear (stern) side of the scanner unit. Remove the cover and turn off (to the lower side) the safety switch.

Safety switch

2) Remove the pedestal cover.
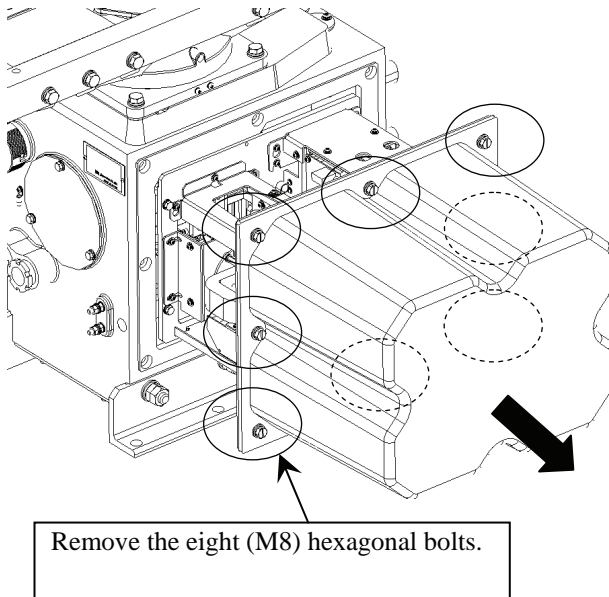
The magnetron is located at the right (starboard) side. Remove the left side cover.

The cover is fixed with 6 (M8) hexagonal screws.

Put the remove cover to safety place, and be careful that there is foreign matter or dust adhered to the gasket.

Remove the eight (M8) hexagonal bolts.

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3) Remove the fan unit.

Remove the four (M4) screws.
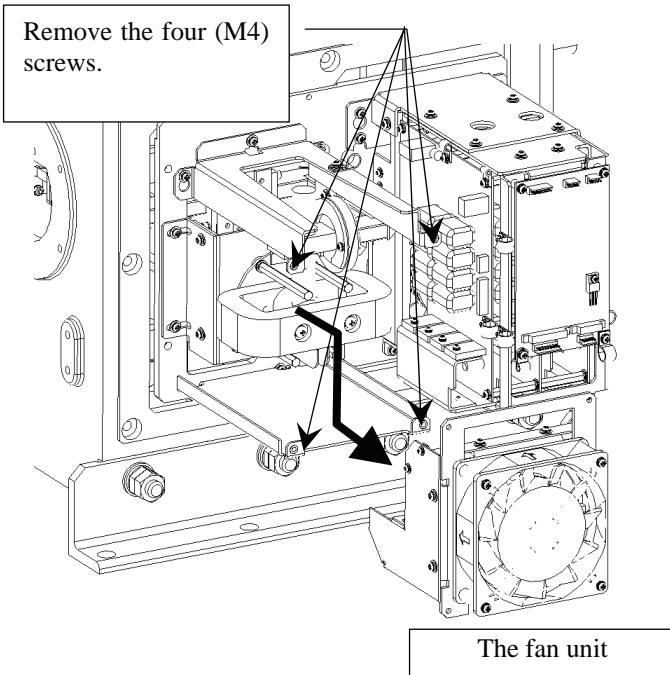
The magnetron is located behind the fan unit. After removing the four (M4X10) screws then remove the fan unit.

Be careful not to lose any of the removed screws.

The fan unit

4-1) Remove the attachment plate.

The place of attachment
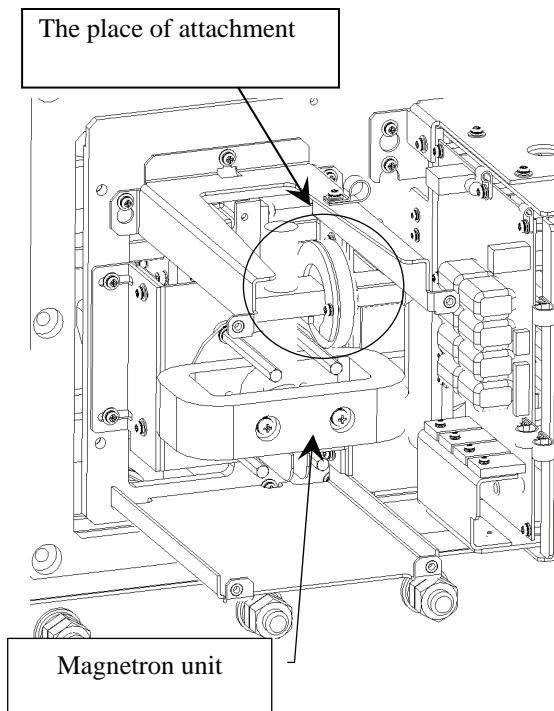
Magnetron unit

The place of attachment between the magnetron and microwave circuits is fixed with the attachment plate so that there is no gap.

To remove the magnetron unit, the attachment plate needs to be removed at first.
After removing two (M4X10) screws holding the attachment plate in place then remove the attachment plate.

The attachment plate

Remove the two screws.

8
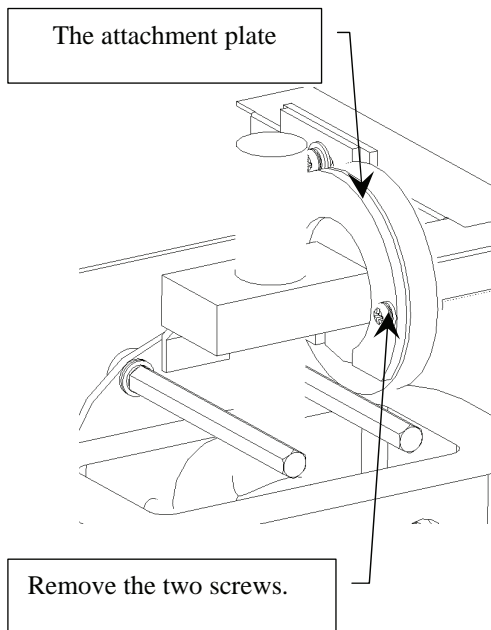
4-2) Remove the magnetron unit.

The magnetron socket
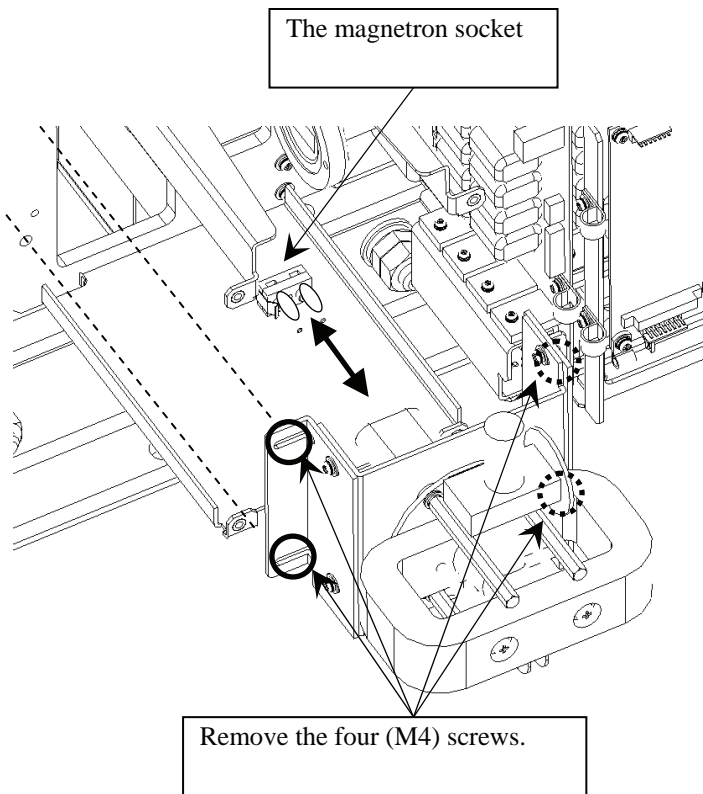
Remove four (M4) screws holding the magnetron unit in place and magnetron socket and then remove the unit.

⚠ Be careful not to cut the cable of magnetron socket.

Remove the four (M4) screws.

The magnetron socket
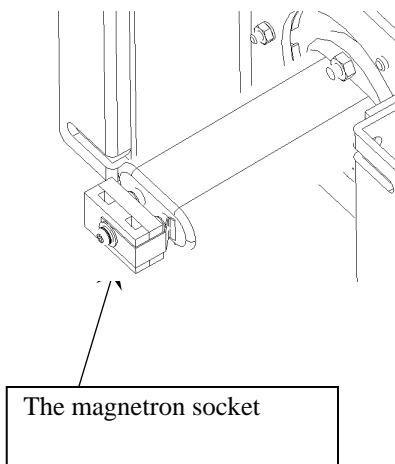
5) Replace the magnetron.

Remove the four (M4) hexagonal bolts.

long

short
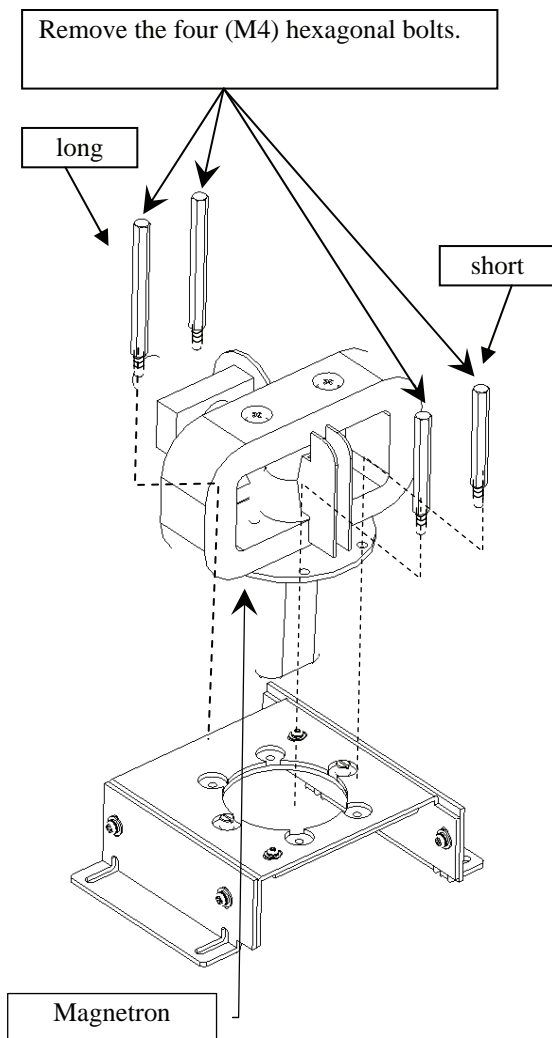
Magnetron

Remove the four hexagonal bolts holding the magnetron in place and then replace the magnetron.

⚠ Use an anti-magnetic screwdriver because the contact of the metal tool with the magnetron causes deterioration of its performance.

Reconnect the magnetron socket to new magnetron.
After having replaced the magnetron, reassemble the unit by following the disassembly procedure in the reverse order.

⚠Pay attention not to make a gap between magnetron and microwave circuits, not to forget to tighten the screws and bolts and to connect the cables.

8

Install the new magnetron together with the fixture and tighten the screws to hold the cables.
Follow the removal procedure in the reverse order.
Do not forget to tighten the screws and connect the cables.

Magnetron Replacement Procedure for Scanner Unit NKE-3710-8

Before starting part replacement work, turn off the safety switch of the scanner unit.

1) Turn off the safety switch.
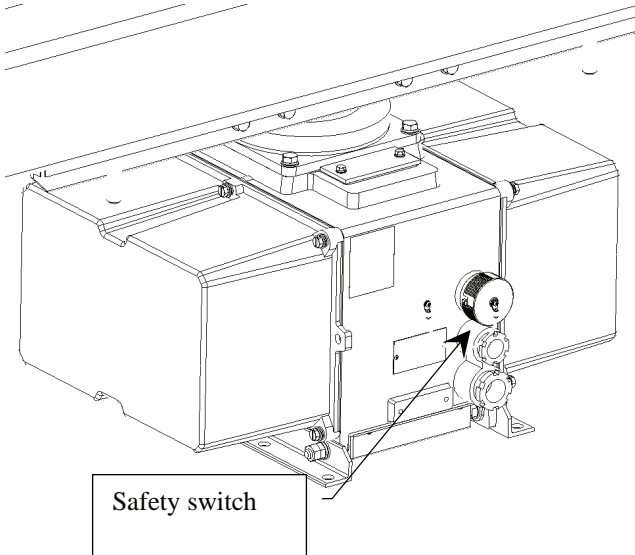
The safety switch is located on the rear (stern) side of the scanner unit. Remove the cover and turn off (to the lower side) the safety switch.

Safety switch

2) Remove the pedestal cover.
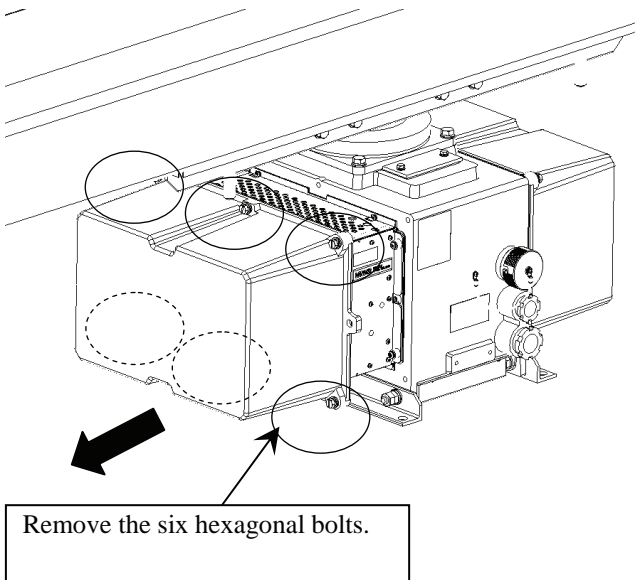
The magnetron is located at the left (port) side. Remove the left side cover.

The cover is fixed with 6 (M8) hexagonal screws.

Put the removed cover to safety place, and be careful that there is no foreign matter or dust adhered to the gasket.

Remove the six hexagonal bolts.

3) Remove the magnetron cables.

The magnetron is located behind the modulator unit.

Loosen the 12 screws holding the cover in place, and remove the cover.

The modulator unit

Remove the 12 screws

Magnetron cable (Yellow)
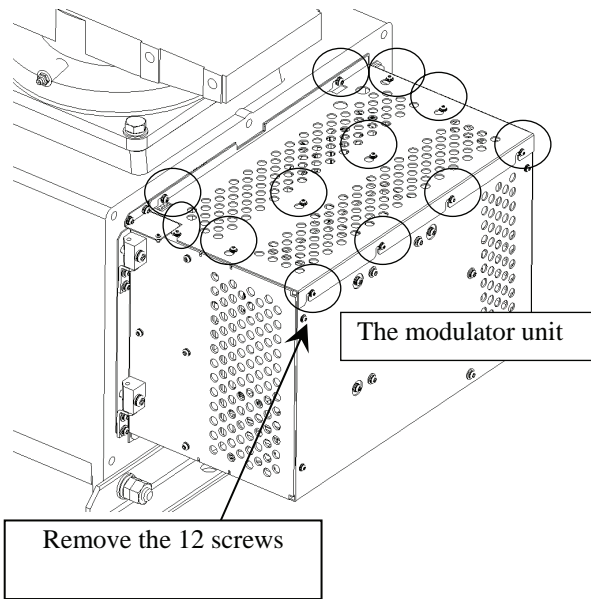
Remove the magnetron cables (yellow and green) connected to pulse transformer.

Be careful not to lose any of the removed screws.

The modulator unit

Pulse transformer

Magnetron cable (Green)

8
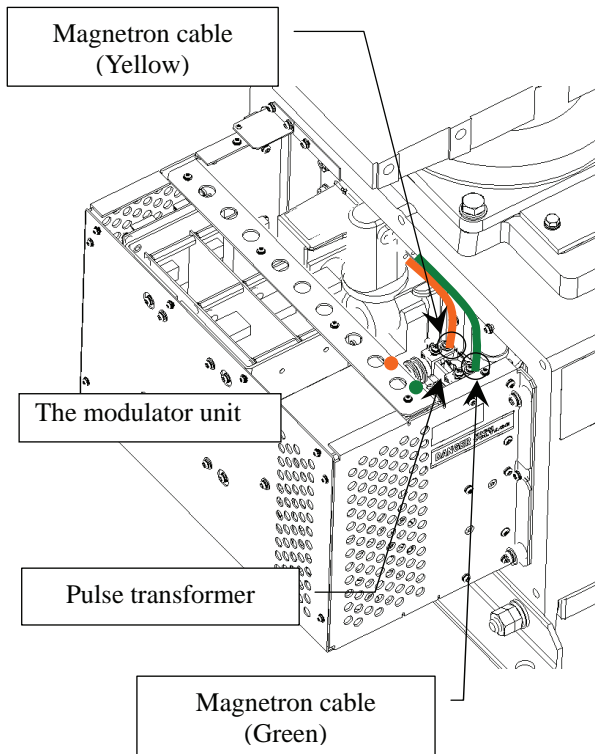
4) Remove the modulator unit.
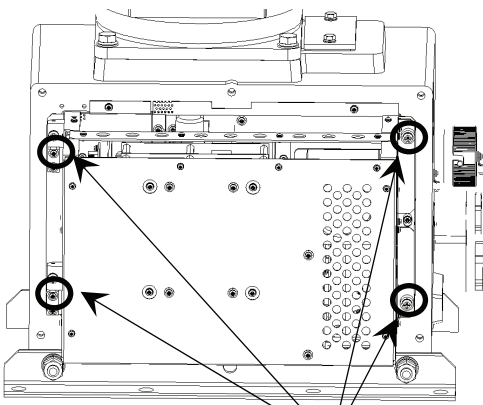
Loosen the four (M6) screws holding the modulator unit in place, and open it.

⚠ The left side of the modulator unit is made by hinge structure.

Remove the 4 screws

After open the modulator unit and remove P/J201 and P/J202 connector, push it up and remove it.

Remove P/J201 connector

Put the removed unit on safety place.

⚠ Extreme care should be taken to connect the P/J201 and P/J202 for prevention of contact with the magnetron or the pulse transformer.
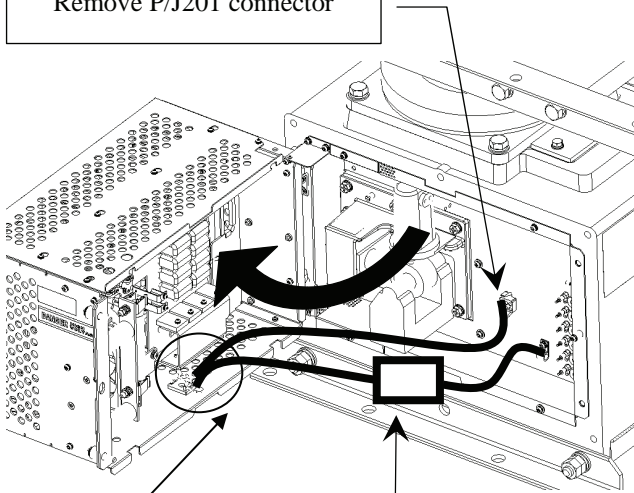
Wire band

Remove P/J202 connector

5) Replace the magnetron.

Magnetron

Remove the 10 screws
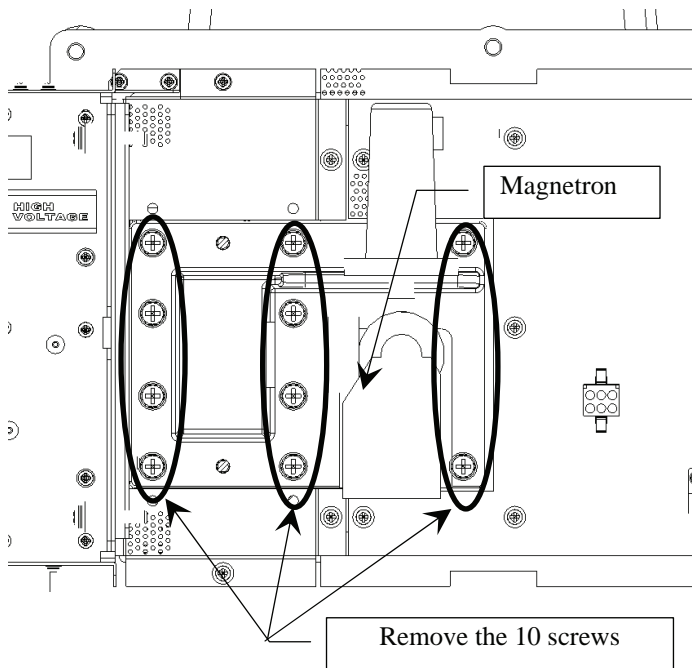
Remove the 10 screws (M6X20) holding the magnetron in place then replace the magnetron.

⚠ Use an anti-magnetic screwdriver because the contact of the metal tool with the magnetron causes deterioration of its performance.

After having replaced the magnetron, reassemble the unit by following the disassembly procedure in the reverse order.

Do not forget to tighten the screws and connect the cables.

8

8.4.3 Replacement of LCD Monitor

Caution: Replacement of LCD Monitor must be made by specialized service personnel.
For details, refer to Field Service Manual.

┌─── Attention ──────────────────────────┐

● **When replacing the LCD monitor, which is easily broken by a little impact, handle it carefully and do not hit any article against it or put it on a hard article.**

└──┘

(1) Disconnect the cables from the connectors "VIDEO" and "VIDEO DC OUT" on the rear of the processor.

(2) Softly place the LCD monitor on a desk covered with a soft cloth.

(3) Attach a new LCD monitor in the reverse sequence as described above.

8.4.4   Replacement of Backup Battery

Caution: Replacement of backup battery must be made by specialized service personnel.
                      For details, refer to Service Manual.

A coin-cell battery maintains radar system configuration, date, and time information while power off
condition.   radar system configuration is saving to non-volatile memory at fixed intervals.

About the Battery Alarm

If Battery Low   is appeared at the lower-right of the display when start up the radar system, the battery
has not enough time left to live.   We recommend to replace the battery.
If Battery Dead   is appeared at the lower-right of the display when start up the radar system,
the battery has no time left to live.   There is a necessary to replace the battery.   In This condition, this
radar system is restored configuration information from flash memory and normal operation is available.
However, you turned of the radar system before saving to flash memory, the configuration information is
maybe lost.   In this case, you must setup the configuration again.

Note: About disposal of used battery, refer to Section 10.2.

How to Replacement of Backup Battery

1. Remove the Coin-Cell Battery from the Holder

Be careful, don't break holder.

3. Fix the Coin-Cell Battery in the Holder

Turn up + surface.
Battery type : CR2032

8

SECTION 9
TROUBLESHOOTING AND
AFTER-SALES SERVICE

9.1 FAULT FINDING

In case of semiconductor circuits, it is deemed that there are few cases in which the used semiconductor devices have inferior quality or performance deterioration except due to insufficient design or inspection or by other external and artificial causes.   In general, the relatively many causes are disconnection in a high-value resistor due to moisture, a defective variable resistor and poor contact of a switch or relay.

Some troubles are caused by defective parts, imperfect adjustment (such as tuning adjustment) or insufficient service (such as poor cable contact).   It will also be effective to check and readjust these points.

9.1.1 List of Alarms and other Indications

If any of the following alarm occurs, the system displays the alarm message in red in order to attract the attention of operator. Other messages are displayed with the suitable color which is yellow or blue depending on the level of message importance.

Alarm	:Red	:Collision-related Alarm
		:Navigation Alarm
		:System Alarm
Warning	:Yellow	:System Warning
Information	:Blue	:Operation Information
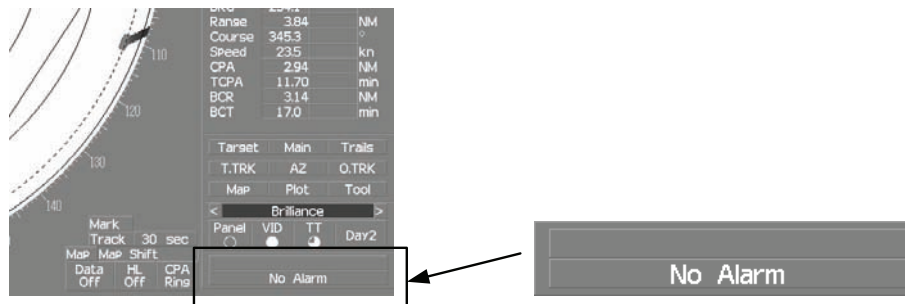
Alarm message is displayed in the lower right of the display. For operation details refer to page2-29 Alarm.

Table 9-1   Critical Alarm

Message	Class	Description	ALR No.
CPA/TCPA	Alarm	There is a dangerous target.	301

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-2   List of System Alarm Message

Message	Class	Description	ALR No.
Autopilot (Data)	Alarm	Autopilot: No communication or data error.	101
Current (Data)	Alarm	Tidal current: No communication or data error.	119
Date (Data)	Alarm	Date data: No communication or data error.	112
Datum (Data)	Alarm	DTM: No communication or data error.	122
Depth (Data)	Alarm	Water depth: No communication or data error.	115
Fan (LCD)	Alarm	LCD monitor: Fan error.	955
GPS (Status)	Alarm	GPS status error.	103
GYRO I/F (Data)	Alarm	GYRO I/F: No communication or checksum error.	324
GYRO I/F (GYRO)	Alarm	GYRO I/F: GYRO error detected.	110
GYRO I/F (Log)	Alarm	GYRO I/F: Log error detected.	111
Heading (Data)	Alarm	Heading data: No communication or data error.	113
Keyboard (Data)	Alarm	Operation unit: Communication error or checksum error.	325
Keyboard2 (Data)	Alarm	Second operation unit: Communication error or checksum error.	325
Out of Bounds	Alarm	Own ship's latitude is over 85°N or 85°S.	123
Position (Data)	Alarm	Latitude / longitude data: No communication or data error.	102
PROC (AZI)	Alarm	Process unit: AZI error.	305
PROC (HL)	Alarm	Process unit: HL error.	306
PROC (Interrupt)	Alarm	Process unit: Interrupt error.	962
PROC (Trigger)	Alarm	Process unit: Trigger error.	304
PROC (Video)	Alarm	Process unit: VIDEO error.	303
ROT (Data)	Alarm	Rate of Turn: No communication or data error.	120
RSA (Data)	Alarm	Rudder Sensor Angle: No communication or data error.	121
Speed (2AXG)	Alarm	2-axis log (speed over ground): No communication or data error.	114
Speed (2AXW)	Alarm	2-axis log (speed over water): No communication or data error.	114
Speed (GPS)	Alarm	GPS speed: No communication or data error.	114
Speed (Log)	Alarm	1-axis log: No communication or data error.	114
SRB (Data)	Alarm	SRB: No communication or data error.	960
TEMP (Data)	Alarm	Water temperature: No communication or data error.	117
TXRX (AZI)	Alarm	Scanner: BP error.	311
TXRX (Data)	Alarm	Scanner: No communication, communication mismatched, checksum error, or collision.	326
TXRX (Fan 1)	Alarm	Power Unit: FAN error.	320
TXRX (HL)	Alarm	Scanner: HL error.	312
TXRX (MHV)	Alarm	Scanner: Modulator's high voltage alarm.	315
TXRX (Reverse)	Alarm	Scanner: Reverse rotation.	313
TXRX (SSW Off)	Alarm	Scanner: Safety switch OFF.	308
TXRX (Trigger)	Alarm	Scanner: TRIGGER error..	310
TXRX (Video)	Alarm	Scanner: VIDEO error.	309
Wind (Data)	Alarm	Wind direction/velocity: No communication or data error.	118

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-3   List of Notification

Message	Class	Description	ALR No.
CCRP Changed	INFO	CCRP is automatically changed.	
Copying	INFO	Displayed-image is capturing to file.	
POSN Reset	INFO	Change the latitude and longitude sentence.	
Set GYRO	INFO	Requires setting of true bearing.	
TM Reset	INFO	Resetting TM in a short time.	
Weather INFO	INFO	Weather information is received.	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-4   List of RADAR Alarm, Target Tracking Alarms and AIS Function Alarms

Message	Class	Description	ALR No.
AIS (Data)	Alarm	AIS: No communication or communication error.	116
AIS 95% Capacity	INFO	Over 95% of the maximum number of AIS targets.	
AIS ACT 95% Capacity	INFO	Over 95% of the maximum number of AIS targets to be activated.	
AIS ACT MAX	INFO	Maximum number of AIS targets to be activated.	
AIS Alarm ***	Alarm	AIS alarm (Up to 10 alarm messages can be displayed.).	
AIS MAX Target	INFO	Maximum number of AIS targets.	
AIS PROC (Data)	Alarm	AIS processing circuit: No communication or communication error.	328
CPA/TCPA	Alarm	There is a dangerous target.	301
Lost	Alarm	Failure in tracking the target that has been under tracking. Failure in receiving AIS target data for a specified time.	
New Target	Alarm	Acquisition or activation of a target in the automatic acquisition / activation zone.	302
RADAR Alarm (In)	Alarm	Targets have entered the radar alarm range.	
RADAR Alarm (Out)	Alarm	Targets have left the radar alarm range.	
REF Target	Alarm	Decrease in the reference target accuracy.	
Trial	Warning	There is a dangerous target, when trial maneuver is active.	
TT (Boot)	Alarm	Target tracking unit start failure.	344
TT (Data)	Alarm	The target tracking unit is malfunctioning..	323
TT 95% Capacity	INFO	Over 95% of the maximum number of targets to be tracked.	
TT MAX Target	INFO	The maximum number of targets is under acquisition.	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-5   List of Route Error Messages and Warnings

Message	Class	Description	ALR No.
Approach	Alarm	Approach the route.	
Arrival	Alarm	Arrive at way point.	
Break Off (WPT)	Alarm	Out of the way point.	
Cross Track Error	Alarm	Go off the route.	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-6   List of Operational Error Messages and Warnings

Message	Class	Description	ALR No.
Can't Transmit	INFO	Tried to transmit within 5 second after standby or when the transmitter-receiver has any trouble.	
Card Full	INFO	Card : Run out of free space.	
Copy Failed	INFO	Card : Copy failure.	
Delete failed	INFO	Card : Deletion failure.	
Format Card	INFO	Card : Unformatted card.	
Format Failed	INFO	Card : Format failure.	
Invalid Card	INFO	Card : Invalid card.	
Invalid Connection	INFO	The operator set performance monitor to on without selecting straight.	
Invalid Data	INFO	Tried to enter any data beyond its range.	
Invalid Range	INFO	TM selection due to TM-disabled range (96 nm). Zooming in a ZOOM-disabled range (0.125 nm).	
MAX Point	INFO	Tried to enter navigation information beyond the specified.	
No Card	INFO	Card not detected yet.	
No Position Data	INFO	Mark or line input when the latitude and longitude is invalid.	
No Heading Data	INFO	Target tracking operation or TM selection when bearing data is invalid.	
No Object	INFO	No object at the cursor-specified position.	
Not Allowed	INFO	General operation error.	
Out of Range	INFO	Out of operation range.	
Read Failed	INFO	Card : Read failure.	
Slave Mode	INFO	Operation of a menu for the scanner unit when the slave mode is active.	
Write Failed	INFO	Card : Write failure.	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

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Table 9-7   List of Conditions Messages

Message	Class	Description	ALR No.
Battery Dead	Warning	The battery is dead.	
Battery Low	Warning	The battery is weakening.	
GPS (HDOP)	Warning	The HDOP level is increased (Decrease in the GPS accuracy.).	
MON Test	Warning	Performance monitor is active.	
No Battery	Warning	The battery had removed.	
Scanner Rotating	Warning	The scanner is rotating (When transmitter is standby state.).	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Table 9-8   List of Interswitch Alarms and Messages

Message	Class	Description	ALR No.
Connection Masked	INFO	Inhibition of control / connection is set.	
ISW (Data)	Alarm	ISW: No communication, data mismatched, or checksum error.	327
ISW Busy	INFO	Access to the ISW menu was made during interswitching.	
ISW Complete	INFO	The switchover of the Interswitch ended normally.	
ISW Error	INFO	The interswitch is disabled.	
TXRX Standby	INFO	The scanner unit is in the standby mode.	
ISW Straight	INFO	The interswitch is forced to change the connection into straight.	
ISW Standby	INFO	The Interswitch recovered normally.	
ISW Time Out	INFO	Failed in switching.	
Master Range CHG	INFO	The range of the own display unit has changed due to change in the range of the master display unit.	
Master Standby	INFO	The master display unit does not transmit any signals.	
Pattern CHG Failed	INFO	Connection change failed.	
Update ISW Software	INFO	Tried to enter new TXRX function, when interswitch software used old version.	

ALR No : Unique alarm number in ALR sentence and ACK sentence.

Message set off in a failure of the monitor fan

When a failure has occurred in the monitor fan, the LCD monitor displays ⟨ ⊙ ⟩ LCD FAN FAILURE at the center.
This display will disappear by pressing the BRIGHTNESS knob on the LCD monitor.   In order to replace the monitor fan, contact our service department, or the distributor.

9.1.2 Operation Checking

When the system is operating, the operation status (located at the upper right of the screen) is changing pictures.
If picture freeze occurred, turn off the system and restart the system.
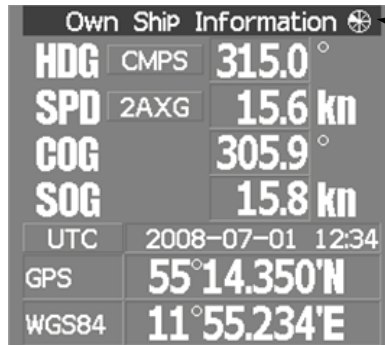
Operation status
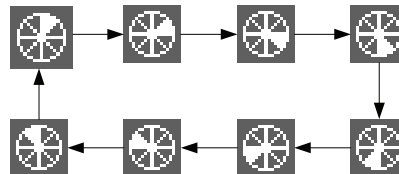
9.1.3 Fuse Checking

Melted fuses are caused by any clear cause.   When a fuse is replaced, it is necessary to check the related circuits even if there is no trouble.   In checking, note that there is some dispersion in the fusing characteristics.   Table 9-9 shows a list of fuses used in the equipment.

Table 9-9   Fuse List

Location	Parts No.	Current Rating	Protection Circuit	Type
Power unit	F601 to F602	3.15A	Power unit NBL-315	MF60NR 250V 3.15
Power unit	F603 to F605	7A	Scanner unit (drive part) NKE-1064/3710-8	MF61-TS7
Power unit	F1	5A	AVR circuit PC620	MF60NR 250V 5
Scanner	F1	1A	Power supply circuit PC230	MF51NR 250V 1
Display Unit	F2 to F3	10A	I/O circuit PC410	MF60NR 250V 10
GYRO I/F unit	F1 to F4	0.5A	GYRO I/F circuit PC4201	MF51NR 250V 0.5

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9.2 TROUBLE SHOOTING

As this radar equipment includes complicated circuits, it is necessary to request a specialist engineer for repair or instructions for remedy if any circuit is defective.
There are also troubles by the following causes, which should be referred to in checking or repair work.
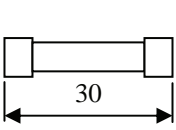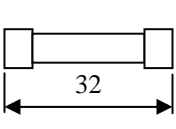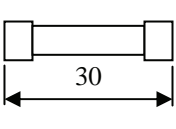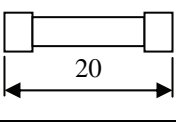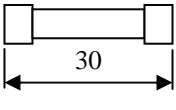
1 Poor Contact in Terminal Board of Inter-Unit Cables

a)   Poor contact in terminal board
b)   The cable end is not fully connected, that it, contacted with earthed another terminal.
c)   Disconnected cable wire

2 Poor Contact of Connector within Unit

Reference: This radar equipment is provided with 9-10 standard spares.

Table 9-10   Spares (7ZXRD0021, JMA-5352-9R, JMA-5362-8R)

7ZXRD0021

Name	Type/Code	Shape (mm)	In use	Spare	Parts No.	Location
Fuse	MF60NR 250V 3.15 (5ZFGD00207)	Φ6 / 30	2	6	F601 to F602	Inside power unit
Fuse	MF61-TS7 (5ZFAA00084)	Φ6.4 / 32	3	9	F603 to F605	Inside power unit
Fuse	MF60NR 250V 5 (5ZFGD00208)	Φ6.4 / 30	1	3	F1	Power unit AVR circuit
Fuse	MF51NR 250V 1 (5ZFGD00199)	Φ5.2 / 20	1	3	F1	Scanner power supply circuit
Fuse	MF60NR 250V 10 (5ZFGD00017)	Φ6.4 / 30	2	6	F2~F3	Inside radar process unit

Caution: Use the specified magnetron in table 9-11.

Table 9-11   Special Parts

[I]   JMA-5352-9R

Parts No.	Name	Type	Manufacturer	Location	Code
V101	Magnetron	2J55	NJRC	Scanner	5VMAA00113
A101	Circulator	NJC3901RJ	NJRC	Scanner	5AJBV00003
A102	TRHPL	TL393	NJRC	Scanner	5VLAA00029

[II]   JMA-5362-8R

Parts No.	Name	Type	Manufacturer	Location	Code
V101	Magnetron	M1461	NJRC	Scanner	5VMAA00108
A101	Circulator	NJC-3314	NJRC	Scanner	NJC-3314
A102	TRHPL	TL378A	NJRC	Scanner	5VLAA00037

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Table 9-12 Circuit Block to be Repaired (JMA-5352-9R)

Location	Circuit Block	Type	Remarks
Scanner	Modulator unit	NMA-486-V	Magnetron, Pulse transformer not included CPA-209A, CCB-542 included
Scanner	Modulator circuit	CPA-209A	
Scanner	PW control circuit	CCB-542	
Scanner	Receiver unit	NRG-210A	
Scanner	I/F circuit	CMH-1658	
Scanner	Power supply circuit	CBA-170	
Scanner	Magnetron	2J55	
Scanner	Motor	MPEM30217*	
Scanner	Encoder	NOY-2048-2MC	
Scanner	Fan (B201)	109L0924H402	
Scanner	Fan (B103)	9G1224H102	
Power unit	AVR circuit	CBA-204B	
Power unit	Interface circuit	CMH-2081	
Power unit	T/R control circuit	CMC-1205V	
Power unit	Fan	109P0424H302	
Process unit	Radar process circuit	CDC-1332	
Process unit	ARPA process unit	NCA-877WA	Option
Process unit	ATA process unit	NCA-877A	Option
Process unit	AIS process unit	NQA-2103	Option
Process unit	GYRO interface circuit	CMJ-304E	
Process unit	Terminal board	CQD-1937A	
Process unit	I/F unit	NQA-2123	
Process unit	Power supply unit	NBD-818A	
Process unit	Fan	7BFRD0005*	
Operation unit	Operation circuit	CCK-979	
Operation unit	I/F circuit	CQC-1204	
Operation unit	Trackball	CCK-1000	
LCD Monitor	Bezel kit	MPBC43590*	for radar
LCD Monitor	Brower circuit	H-CBP-173A	
LCD Monitor	I/F circuit	H-CMH-2227	
LCD Monitor	Inverter circuit	H-CBF-38	
LCD Monitor	Brilliance control circuit	H-CCK-989	
LCD Monitor	19Inch LCD	H-CML-771	

"*" means revision, such as A, B and so on.

Table 9-13 Circuit Block to be Repaired (JMA-5362-8R)

Location	Circuit Block	Type	Remarks
Scanner	Modulator unit	NMA-195A	Magnetron not included CPA-209A, CCB-542 included
Scanner	Modulator circuit	CPA-209A	
Scanner	PW control circuit	CCB-542	
Scanner	Receiver unit	NRG-213A	W103, W104 included
Scanner	I/F circuit	CMH-1658	
Scanner	Power supply circuit	CBA-170	
Scanner	Magnetron	M1461	
Scanner	Motor	MPEM00259B*	
Scanner	Encoder	NOY-2048-2MC	
Scanner	Fan (B201)	9G1224H102	
Power unit	AVR circuit	CBA-204B	
Power unit	Interface circuit	CMH-2081	
Power unit	T/R control circuit	CMC-1205V	
Power unit	Fan	109P0424H302	
Process unit	Radar process circuit	CDC-1332	
Process unit	ARPA process unit	NCA-877WA	Option
Process unit	ATA process unit	NCA-877A	Option
Process unit	AIS process unit	NQA-2103	Option
Process unit	GYRO interface circuit	CMJ-304E	
Process unit	Terminal board	CQD-1937A	
Process unit	I/F unit	NQA-2123	
Process unit	Power supply unit	NBD-818A	
Process unit	Fan	7BFRD0005*	
Operation unit	Operation circuit	CCK-979	
Operation unit	I/F circuit	CQC-1204	
Operation unit	Trackball	CCK-1000	
LCD Monitor	Bezel kit	MPBC43590*	for radar
LCD Monitor	Brower circuit	H-CBP-173A	
LCD Monitor	I/F circuit	H-CMH-2227	
LCD Monitor	Inverter circuit	H-CBF-38	
LCD Monitor	Brilliance control circuit	H-CCK-989	
LCD Monitor	19Inch LCD	H-CML-771	

"*" means revision, such as A, B and so on.

9

9.3 AFTER-SALES SERVICE

9.3.1 Keeping period of maintenance parts

Keeping period of maintenance parts is ten years from the production is discontinued.

9.3.2 When you Request for Repair

If you suppose the product may be out of order, read the description in Section 9 carefully and check the suspected point again.
If it is still out of order, you are recommended to stop operation of the equipment and consult with the dealer from whom you purchased the product, or our branch office in your country or district, the sales department in our main office in Tokyo.

- ● Repair within the Warranty Period
  If any failure occurs in the product during its normal operation in accordance with the instruction manual, the dealer or JRC will repair free of charge.   In case that any failure is caused due to misuse, faulty operation, negligence or force major such as natural disaster and fire, the product will be repaired with charges.

- ● Repair after the Warranty Period
  If any defective function of the product is recoverable by repair, the repair of it will be made at your own charge upon your request.

- ● Necessary Information for Repair
  ☆ Product name, model, manufacturing date and serial number
  ☆ Trouble conditions (as detailed as possible.   Refer to "Radar Failure Check List" in page 9-13.)
  ☆ Name of company/organization, address and telephone number

9.3.3 Recommended Maintenance

The performance of the product may deteriorate due to the secular change of the parts used in it, though such deterioration depends upon the conditions of operation.
So checkup and maintenance is recommendable for the product in addition to your daily care.
For maintenance, consult with the near-by dealer or our sales department.
Such maintenance will be made with charges.

For further details of after-sale service, contact the JRC Offices.

Radar Failure Check List

When placing an order for repair of the product, it is requested that you could confirm the check items and fill the results and sent the sheet to our contact.
If there is any unclear items, contact the ship on which the product is installed, and give the correct information on the product.

Ship name: _____ Phone: _____ Fax: _____
Radar general model name: JMA-_____ Serial No. : _____
(Write the full model name correctly)

(1)Check the following items in the order of the number, and circle the applicable answer between YES or NO.
If the item cannot be determined as YES or NO, explain in detail in the item (18), others.
(2)If any of the items (1) to (5) is marked as NO, check the fuse of the product (refer to Section 9.1.2 and 9.2).
(3)Check the items (4) to (17) while the transmission (TX) is ON.

*Functions mentioned in the items (14), (15) and (17) may be optional, answer is not necessary.

No.	Check Item	Result	
(1)	Power can be turned on.　(The lamp on the Operation unit is lit)	YES	NO
(2)	A few minutes after powering-on, it will become standby status .	YES	NO
(3)	When powering-on (or TX ON), LCD monitor something is lit.	YES	NO
(4)	The antenna rotates at the transmission (TX) ON. (Check the following items while transmission is ON)	YES	NO
(5)	Current is supplied to the magnetron.　(Refer to the instruction manual)	YES	NO
(6)	Turning is enabled.　(Check with the range of 6 NM or more)	YES	NO
(7)	Fixed marker is displayed.	YES	NO
(8)	VRM is displayed.	YES	NO
(9)	While noise is displayed while set at SEA and RAIN minimum, GAIN maximum, IR-OFF and range 48 NM.	YES	NO
(10)	Target reflection echo is displayed.	YES	NO
(11)	Sensitivity of reflection echo is normal.	YES	NO
(12)	EBL is displayed.	YES	NO
(13)	Cursor mark moves.	YES	NO
*(14)	GYRO course can be set and normally displayed.	YES	NO
*(15)	LOG speed can be normally displayed.	YES	NO
(16)	Target tracking function works normally.	YES	NO
*(17)	If equipped with an interswitch, when switching from the straight mode (II) to (X), the failures (items marked NO) in the above (1) to (16), are switched over to the other unit.	YES	NO

(18)Others (Error message, etc.　) _____

_____

_____

_____

_____

SECTION 10
DISPOSAL

10.1 DISPOSAL OF THE UNIT

When disposing of this unit, be sure to follow the local laws and regulations for the place of disposal.

10.2 DISPOSAL OF USED BATTERIES

⚠ **WARNING**

❗ When disposing of used lithium batteries, be sure to insulate the batteries by attaching a piece of adhesive tape on the + and - terminals.   Failure to comply may cause heat generation, explosion, or fire when the batteries get shorted out.

In this unit, Lithium batteries are used for the following parts:
Radar Processing circuit (CDC-1332): BT300 (Maxell: CR2032)

● Do not store used lithium batteries.   Dispose of them in accordance with regulations of local government.
● When disposing of used lithium batteries be sure to insulate the batteries by taping the + and - terminals.   For disposal of batteries, be sure to follow the local laws and regulations. For detail, consult with the dealer you purchased the product our business office, or local government.

10.3 DISPOSAL OF USED MAGNETRON

Magnetron is used in the Scanner （NKE-1064/3710-8）

● When the magnetron is replaced with a new one, return the used magnetron to our dealer or business office.
For detail, consult with our dealer or business office.

10.4 DISPOSAL OF TR-TUBE

In the case that either mark shown in Fig.10.1 is on the expired TR-tube, Radioisotopes are in the TR-tube

● Disposal of TR-tube with these marks must be done in accordance with the laws and regulations of the pertaining country.
For detail, consult with our dealer or business office.
● Radiation from TR-tube has no effect on the human body.
● Don't take apart TR-tube.

Fig.10.1

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10.5 ABOUT THE CHINA ROHS

有毒有害物质或元素的名称及含量
(Names & Content of toxic and hazardous substances or elements）
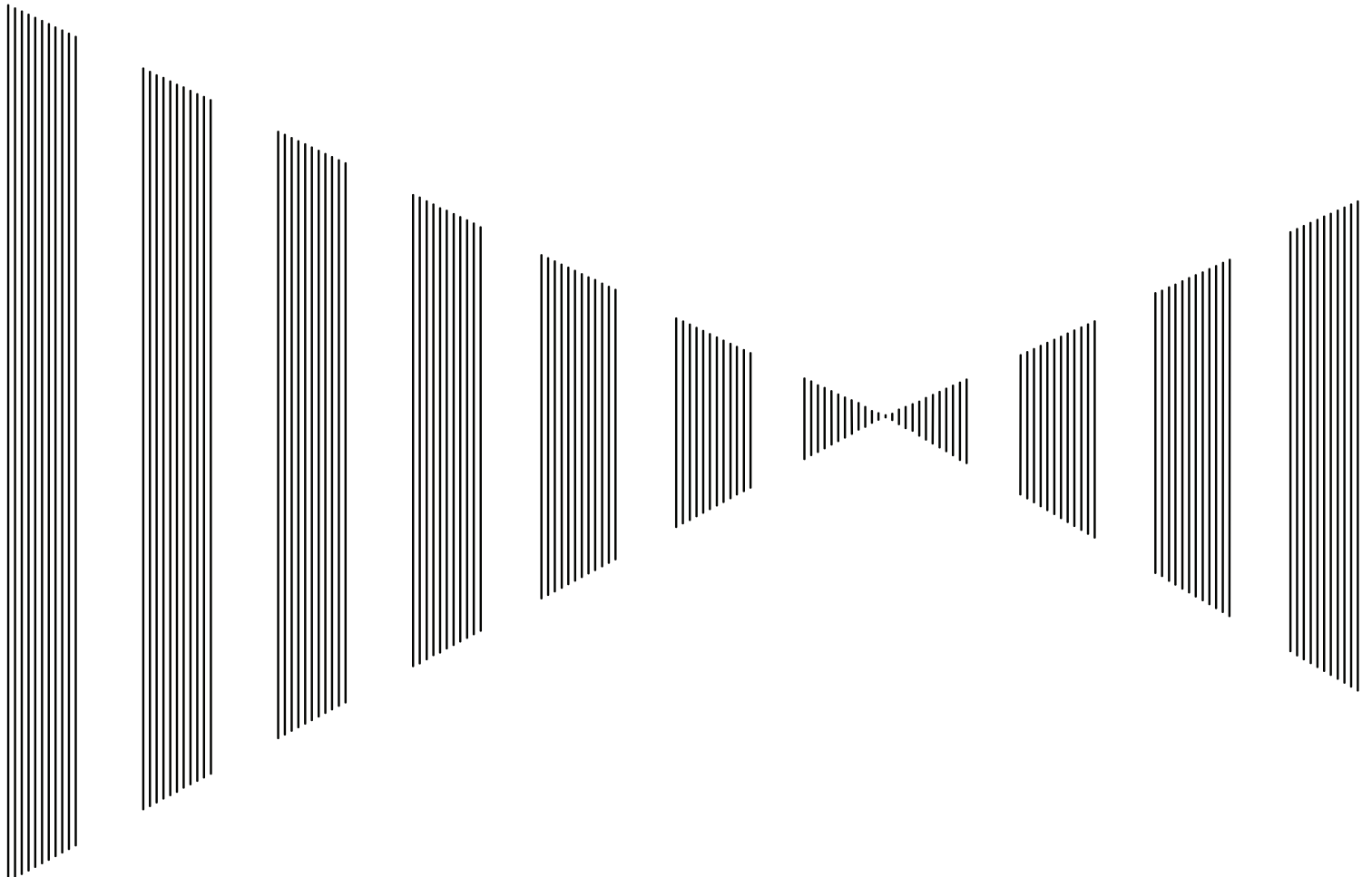
形式名(Type): JMA-5352-9R, JMA-5362-8R   名称(Name): RADAR

部件名称 (Part name)	有毒有害物质或元素 (Toxic and Hazardous Substances and Elements)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
雷达天线单元 (Scanner Unit)	✕	✕	✕	✕	✕	✕
收发信单元 (Transmitter-receiver Unit)	✕	✕	✕	✕	✕	✕
主船内装置 (Inboard Unit) ・显示装置 (Display Unit) ・键盘装置 (OperationUnit) ・信号处理装置 　(RADAR Process Unit)	✕	✕	✕	✕	✕	✕
外部设备 (Peripherals) ・选择 (Options) ・电线类 (Cables) ・手册 (Documennts)	✕	✕	✕	✕	✕	✕

○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11306-2006 标准规定的限量要求以下。
  (Indicates that this toxic, or hazardous substance contained in all of the homogeneous materials for this
   part is below the requirement in SJ/T11363-2006.)

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。
  (Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials
   used for this part is above the limit requirement in SJ/T 11363-2006.)

SECTION 11
SPECIFICATIONS

11.1 JMA-5352-9R, JMA-5362-8R TYPE RADAR

(1) Class of emission   P0N

(2) Display   Color Raster Scan

(3) Screen   19-inch Color LCD
                                      Effective diameter of radar display, more than 250 mm

(4) Range Scale   0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 48, 96 NM

(5) Range Resolution   Less than 25 m

(6) Minimum Detective Range   Less than 28 m

(7) Range Accuracy   Less than 1 % of the maximum distance of the range scale in
                                      use or less than 15m whichever is larger

(8) Bearing Accuracy   Less than 1 °

(9) Bearing Indication   Relative Motion mode: Head-up/Course-up/North-up
                                      True Motion mode: Course-up/North-up

(10)   Ambient Condition   Temperature
                                              Scanner: -20 to +50 ℃
                                              (Storage Temperature: -25 to +70 ℃)
                                              Other Unit except Scanner: -10 to +50 ℃
                                      Relative Humidity   95 % at +35 ℃
                                              0-500 cpm   amplitude   3 mm
                                              500-1500 cpm   amplitude   0.75 mm
                                              1500-3000 cpm   amplitude   0.2 mm
                                      Velocity of the wind 36.0 m/s (70 knot)

(11) Power Supply Input   +24VDC (Display Unit)
                                      +220VAC, 3 ϕ, 50/60Hz (Scanner)
                                      * Display Unit correspond to 100/110/115/220/230/240VAC,
                                        1 ϕ, 50/60Hz
                                        when use NBA-5111.

(12) Power Consumption   Approx. 100 W+600VA (typical)

(13) Power Supply Voltage Fluctuation +24 VDC –10/+50 % (Display Unit)
                                      220 VAC ±10 % (Scanner Unit)

(14) Pre-heating Time   Approx. Within 3 min

11.2   SCANNER UNIT (NKE-1064)

(1)	Dimensions	Height 714 mm × Swing Circle 2806 mm
(2)	Mass	Approx. 100 kg
(3)	Polarization	Horizontal Polarization
(4)	Directional Characteristic	Horizontal Beam Width: 0.8 ° (-3 dB width) Vertical Beam Width: 20 ° (-3 dB width) Sidelobe Level: Below -26dB (within ±10 °) Below -30dB (outside ±10 °)
(5)	Revolution	Approx. 17/14 rpm (60/50 Hz)
(6)	Peak Power	50 kW ±5 0%
(7)	Transmitting Frequency	9375 ±30 MHz
(8)	Transmitting Tube	Magnetron [2J55]
(9)	Pulse width/Repetition Frequency	

SP1: 0.08 μs/1700 Hz
MP1: 0.25 μs/1700 Hz
LP1: 0.75 μs/860 Hz, LP2: 1.0 μs/650 Hz

0.125 NM	SP1
0.25 NM	SP1
0.5 NM	SP1
0.75 NM	SP1 / MP1
(1 NM)	SP1 / MP1
1.5 NM	SP1 / MP1 / LP1
(2 NM)	SP1 / MP1 / LP1
3 NM	SP1 / MP1 / LP1
(4 NM)	SP1 / MP1 / LP1
6 NM	MP1 / LP1 / LP2
(8 NM)	MP1 / LP1 / LP2
12 NM	MP1 / LP1 / LP2
(16 NM)	MP1 / LP1 / LP2
24 NM	LP2
(32 NM)	LP2
48 NM	LP2
96 NM	LP2

(10)	Duplexer	Circulator + TRHPL
(11)	Mixer	MIC Front End
(12)	Intermediate Frequency Amplifier	Intermediate Frequency: 60 MHz Band Width: 20 MHz (0.08 μs) 6 MHz (0.25 μs) 3 MHz (0.75 μs, 1 μs) Gain: More than 90 dB Amplifying Characteristics: Logarithmic Amplifier
(13)	Overall Noise Figure	7.5 dB (Average)

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11.3 SCANNER UNIT (NKE-3710-8)

(1) Dimensions   Height 690 mm × Swing Circle 2730 mm

(2) Mass   Approx. 98 kg

(3) Polarization   Horizontal Polarization

(4) Directional Characteristics   Horizontal Beam Width: 2.7 ° (-3 dB width)
                                             Vertical Beam Width   22 ° (-3 dB width)
                                             Sidelobe Level: Below -26dB (within ±10 °)
                                                                          Below -30dB (outside ±10 °)

(5) Revolution   Approx. 17/14 rpm (60/50 Hz)

(6) Peak Power   60 kW ±50 %

(7) Transmitting Frequency   3050 ±25 MHz

(8) Transmitting Tube   Magnetron [M1461]

(9) Pulse width/Repetition Frequency

                                             SP1: 0.08 μs/1700 Hz
                                             MP1: 0.25 μs/1700 Hz
                                             LP1: 0.75 μs/860 Hz, LP2: 1.0 μs/650 Hz
                                             0.125 NM   SP1
                                             0.25 NM   SP1
                                             0.5 NM   SP1
                                             0.75 NM   SP1 / MP1
                                             (1 NM)   SP1 / MP1
                                             1.5 NM   SP1 / MP1 / MP2
                                             (2 NM)   SP1 / MP1 / MP2
                                             3 NM   SP1 / MP1 / MP2
                                             (4 NM)   SP1 / MP1 / MP2
                                             6 NM   MP1 / LP1 / LP2
                                             (8 NM)   MP1 / LP1 / LP2
                                             12 NM   MP1 / LP1 / LP2
                                             (16 NM)   MP1 / LP1 / LP2
                                             24 NM   LP2
                                             (32 NM)   LP2
                                             48 NM   LP2
                                             96 NM   LP2

(10) Duplexer   Circulator + TRHPL

(11) Mixer   MIC Front End

(12) Intermediate Frequency Amplifier   Intermediate Frequency: 60 MHz
                                             Band Width (NRG-213):   25 MHz (0.08 μs)
                                                                          6 MHz (0.25 μs)
                                                                          3 MHz (0.75 μs, 1 μs)
                                             Band Width (NRG-213A):   25 MHz (0.08 μs)
                                                                          8 MHz (0.25 μs)
                                                                          3 MHz (0.75 μs, 1 μs)
                                             Gain: More than 90 dB
                                             Amplifying Characteristics: Logarithmic Amplifier

(13)   Overall Noise Figure   7.5 dB (Average)

11.4 DISPLAY UNIT (NCD-4530)

(1) Structure   Desktop Type
                                 (LCD Monitor/Operation Unit/Processor Unit Separation Structure)

(2) Screen   19-inch Color LCD   1280x1024 dot (SXGA)
                                 Viewing Distance: 1m from the center of Display

(3) Display mode   Radar mode
                                 Synthesis mode (Synthesis Radar echo and Coastline)
                                 Plotter mode (Require Plotter Unit (option))

(4) Range Scale   0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 48, 96 NM

(5) Range Marker   0.025, 0.05, 0.1, 0.25, 0.25, 0.5, 1, 2, 4, 8, 16 NM

(6) Bearing Indication   Rader mode/Synthesis mode
                                 Relative motion: North-up, Course-up, Head-up
                                 True motion: North-up, Course-up
                                 True motion (Plotter mode (Option)): N-up, C-up

(7) Variable Range Maker   2VRM (Digital Display)
                                 VRM unit of Display: NM
                                 VRM Range: 0.000 to 97.2NM

(8) Electric Bearing lines   2EBL(Digital Display)
                                 Each EBL can be floating displayed.
                                 EBL unit of Display: 0.1 °
                                 EBL Range: 0.000 ° to 359.9 °
                                 Bearing Indication: Relative bearing and True bearing can be switched.

(9) Cursor   Target Range, Bearing and Latitude presentation can be possible to
                                 move with trackball.

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11.5 PROCESSOR UNIT (NDC-1417)

(1)	Structure	Desktop Type (Horizontal putting and length putting using combined)
(2)	Dimensions	Height 170 mm × Width 300 mm × Depth 320 mm
(3)	Mass	Approx. Below 10 kg
(4)	Tune Method	AUTO/MANUAL (Bar-graph indicate)
(5)	STC (SEA)	AUTO/MANUAL
(6)	FTC (RAIN)	AUTO/MANUAL
(7)	Radar Interference Rejection	Built-in (The effect can be adjusted by three stages.)
(8)	Scan Correlation	Function1/2/3, Peak Hold Processing1/2 Automatic change of processing method. (Target range synchronize/Clutter synchronize)
(9)	Bearing Marker	360 ° in 1 ° digit. Relative motion: Fixation True motion: Rewrite at a position correct in every scan.
(10)	Heading Line	Electronic (Stern Line can be displayed.)
(11)	Radar Alarm	Invasion, Secession, OFF can be selected. With buzzer sound. (Possible to output to external buzzer.) Sector zone, Processing to range, theta domain, Relative position. Automatically acquisition by target tracking described in Section "TARGET TRACKING".
(12)	Off Center	Within 66 % of the radius of any range. (Except 96NM) Can be operated in all mode in relative motion. Trail is succeed at Off Center mode.
(13)	True motion Unit	Built-in (Except 96NM)
(14)	True motion reset position	66 % of radius of any range. Possible to manual reset.
(15)	Twice zoom	The zoom center is 66% radius of any range. (Except 0.125 NM)

(16)   Radar trails indication

True motion mode:(Only true motion trails
Relative motion mode:
 True motion trails and relative motion trails can be selected.
Trail time length:
 15 sec/30 sec/1 min/3 min/6 min/10 min/15 min/30 min/60 min/Continuous/OFF
Arbitrary trail time length can be displayed at any time.
Possible to display time series trail and continuous trail by color classification.
Built-in Trail thinning process.
Trail function can be use at true motion reset.
When range is changed, Trail function can be use.
Trail function can be use at Off Center. (Relative motion)
When motion indication and bearing indication changed, Trail function can be use. (Only true motion trails indication.)

(17)   Variety of Pulse width

SP1/MP1/MP2/LP1 (NKE-1064/NKE-3710-8)

(18)   Target enhance

3 stages can be changed.

(19)   Correct position

When synthesis Radar and Coastline is displayed, position can be corrected by manually.

(20)   Display color

Radar echo: 16 stages (Yellow, Green, Amber, Purple, Red)
Radar trails: 16 stages (White, Cyan, Green)
Fixed Maker: 4 colors (White, Cyan, Green, Amber)
VRM1/2,EBL1/2,PI: 4 colors (White, Cyan, Green, Amber)
Character/Bearing Marker: 5 colors (White, Green, Amber, Black, Red)
Cursor: 4 colors (White, Cyan, Green, Amber)
Heading Line/Vector: 4 colors (Cyan, Green, Amber, Black)
Own Ship's track/Another Ship's track: 7 colors
Coastline/Isobaths: 16 colors
Mark/Line: 7 colors

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11.6 TARGET TRACKING FUNCTION (OPTION)

Radar mode, synthesis mode

(1) Available range scale	All range
(2) Acquisition	MANUAL/AUTO(by two automatic acquisition/activation zone)
	Acquisition range: 0.1 to 32 NM (Available all range scale)
(3) Tracking	Normal edition type NCA-877A: 30 target
	High performance type NCA-877WA: 100 target
	Tracking range: 0 to 32 NM (Available all range scale)
(4) Display	Tracking data: 4 at the same time. (Can be scroll.)
	Naming function: Possible to name by the alphabet up to 8 characters to each target.
	The range, bearing, CPA, TCPA, true course, true speed, BCR, BCT of target can be displayed. (When naming is displayed, BCR/BCT can't be displayed.) Vector display: True/Relative Past position
(5) Alarm	Automatic acquisition/activation zone
	Danger ship: Depends on CPA/TCPA setting.
(6) Trial Maneuver (NCA-877WA)	Input parameter: Course, Speed, Vector time, Time to Maneuver, Reach, Turn Radius, Acceleration, Deceleration

Synthesis mode

(7) Another ship track	20 targets. 1500 point per one target can be displayed. (Own ship track and marks are another.)
	Display color: 7 colors (The display color of each target can be set.) (The display color of all targets can be set by the batch. In this case, the display color is one color.)
	Interval of save: 3/5/10/30 sec, 1/3/5/10/30/60 min, 1/3/5/10 NM
	Possible to storage in memory card (Option).

11.7 AIS PROCESS UNIT (NQA-2103) (OPTION)

Radar mode, synthesis mode

(1) Activation	100 target
	MANUAL/AUTO(by two automatic activation/activation zone)
(2) Display	300 target (sleeping target and activated target)
	AIS data: 2 at the same time. (simple display)
	The ship's name, call sign, MMSI, course, speed, CPA, TCPA of target can be displayed. (simple display item)
	The ship's name, call sign, MMSI, course, speed, CPA, TCPA, bearing, range, ship's heading bearing, rate of turn, latitude, longitude, destination, navigation status of target can be displayed. (detail display item)
	Vector display: True/Relative
	Past position
	The message can be displayed. (broadcast message, addressed message)
(3) Alarm	Automatic activation/activation zone
	Danger ship: Depends on CPA/TCPA setting.

Synthesis mode

(4) Another ship track	20 targets. 1500 point per one target can be displayed.
	(Own ship track and marks are another.)
	Display color: 7 colors
	(The display color of each target can be set.)
	(The display color of all targets can be set by the batch. In this case, the display color is one color.)
	Interval of save: 3/5/10/30 sec, 1/3/5/10/30/60 min, 1/3/5/10 NM
	Possible to storage in memory card (Option).

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11.8 PLOTTER

(1) Plotter (Normal) (Synthesis mode)

Projection:	Mercator projection (Latitude 85 degree or less.)
Scale:	Radar synchronize range scale
Own ship track:	1 color (Cyan)
	Interval of save 3/5/10/30 sec, 1/3/5/10/30/60 min or every 0.1/0.2/0.3/0.5/1/3/5/10 NM and Off
	Capacity 7,000 point
Cursor mark:	7 colors
	Capacity of cursor mark: 2,000 point
	Variety of cursor Mark: 29
Line:	7 colors
	Capacity of line: Include in cursor mark
	Variety of line: Solid line, broken line, alternate long and short dash line
Coastline data:	Coastline ROM Card (Option) (ERC, JRC, C-Map NT+)
	One selected depth contour can be displayed.
External memory:	Memory card (Option)
Position correction:	Latitude / Longitude correction
	Radar video synchronize range scale coast line by manual. (Synthesis mode)

(2) Plotter (Option NDB-34A) (Synthesis mode, Plotter mode)

Projection:	Mercator projection (Latitude 70 degree or less.)
Scale:	Synchronize range scale (Synthesis mode)
	1/1,000 to 1/10,000,000 are continuously selected. 10 stage can be changed (preset can be used). (Plotter mode)
Own ship track:	7 colors.
	Interval of save: 3/5/10/30 sec, 1/3/5/10/30/60 min or every 0.1/0.2/0.3/0.5/1/3/5/10 NM and Off
	Capacity of own ship track: 7,000 point
Cursor mark:	7 colors
	Capacity of cursor mark: 20,000 point
	Variety of cursor Mark: 29
Line:	7 colors
	Capacity of line: Include in cursor mark
	Variety of line: Solid line, broken line, alternate long and short dash line
Coast line data:	Coast line ROM card (Option)(ERC, JRC, C-Map NT+)
	Selected one depth contour can be displayed.
External memory:	Memory card (Option)
Waypoint and route:	Waypoint can be set up to 999 point.
	Information of waypoint: Azimuth, distance and the time to required destination.
	Setting of sea route: 10 sea routes. (20 destination for one route can be set.)
	Alarm of route: Waypoint arrival / break off, Route arrival / break off
Position correction:	Latitude / Longitude correction
	Radar video synchronize range scale coast line by manual. (Synthesis mode)

11.9 OPERATION UNIT (NCE-5171)

(1) Structure   Structure of operation unit is separate from processor unit.
Desk-Top type
Correspond Flush mount

(2) Switch

GAIN/PL:	Adjust the reception gain. (Transmit pulse width can be changed by PUSH-SW.)
AUTO-SEA:	Sea clutter suppression. (AUTO/MANU can be changed by PUSH-SW.)
AUTO-RAIN:	Rain clutter suppression. (AUTO/MANU can be changed by PUSH-SW.)
MULTI:	Change the setting. (Adjustment item can be changed by PUSH-SW)
EBL (Electric Bearing Line):	Rotate the bearing of the EBL (Floating EBL ON/OFF can be changed by PUSH-SW.)
VRM (Variable Range Marker):	Change the VRM range.

(3) Operation switch

Trackball:	Move the cursor mark.
STBY/OFF (Standby/Power off):	Stop transmit, Power off.
TX/OFF (Transmit Start/Power Off):	Start transmit, Power off
PANEL (Brightness of Keyboard Adjustment):	Brightness of keyboard switch adjust.
ALARM ACK (Alarm Acknowledge):	Acknowledge and stop alarm.
EBL1:	Selection display and non-display of EBL1.
EBL2:	Selection display and non-display of EBL2.
VRM1:	Selection display and non-display of VRM1.
VRM2:	Selection display and non-display of VRM2.
RANGE+ (Increase Display Range):	Increase display range.
RANGE- (Decrease Display Range):	Decrease display range.
ACQ (Acquisition):	Target acquisition
TGT DATA (Numeric Display):	Numeric display of tracking target.
TGT CNCL (Cancel of Selection):	Release of selection of tracking target.
MOB (Marker):	Turning on and release marker.
ENT (Enter):	Left side button of trackball.
CLR/INFO (Clear/Information):	Right side of trackball.
MAP (Display Mode):	Selection display and non-display of MAP(NAV LINE, etc…). Selection of Rader, Synthesis and Plotter mode.
AZI MODE (Display Azimuth Mode):	Selection of North-up, Course-Up, Head-Up.
TM/RM (True/Relative Motion):	Selection true motion, relative motion.
RR/HL (Range Ring/Heading line):	Selection display and non-display of fixed ring and heading line.
OFF CENT(Off Center):	Off center operation
AZ (Automatic Acquisition/Activate zone):	Setting and release of acquisition/activation zone.
VECT T/R (True/Relative Motion Vector):	Selection of true motion and relative motion of vector.
TRAILS:	Switching trails display time.
DAY/NIGHT:	Selection of screen arrangement of color.
FUNC (Function):	Selection of signal processing.
USER KEY1:	User assignment key1.
USER KEY2:	User assignment key2.
RADAR MENU:	Rader menu.
MARK:	Selection display and non-display of mark.
TT MENU:	Target tracking menu.

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11.10 AVAILABLE INPUT SIGNAL

Receive capability Port: .NAV1, NAV2, GPS port at terminal board TB4303. NMEA Connecter at rear of the process unit (D-Sub 9 PIN)

(1)	Navigation equipment:	IEC61162-1/2	
		Longitude/Latitude:	GGA > RMC > RMA > GNS > GLL
		Waypoint:	RMB>BWC>BWR
		COG/SOG:	RMC>RMA>VTG
		SPEED:	VBW
		Day/Time information:	ZDA
		Alarm acknowledge:	ACK
		Rate of Turn :	ROT
		Rudder :	RSA

(2)   Bearing signal: GYRO-SYNC: 360X, 180X, 90X, 30X. (GYRO I/F Unit)
GYRO-STEP: 360X, 180X, 90X, 30X. (GYRO I/F Unit)
JRC-NSK format (JLR-10,20,30) (COMPASS Connector at rear of the process unit)
IEC61162-2 38400bps: THS>HDT (over 40Hz) (COMPAS port at terminal board TB4303).
IEC61162-1 4800bps: HDT>HDG>HDM>VHW (COMPAS port at terminal board TB4303). ※Can't be use for target tracking.

(3)   Speed signal: LOG-SYNC: 360X, 180X,90X, 30X. (GYRO I/F Unit)
LOG-PULSE: 800, 400, 200, 100. (GYRO I/F Unit)

(4)   External event mark: Contact input (EVENT port at terminal board TB4303).

(5)   Radar buoy: Negative input (RBVD port at terminal board TB4302).

(6)   Depth: DPT>DBS>DBT>DBK, JRC format

(7)   Water temperature: MTW, JRC format

(8)   Tendency: CUR, JRC format

(9)   Direction of wind, velocity of wind: MWV, MWD

(10)   AIS: VDM, VDO

11.11   AVAILABLE OUTPUT SIGNAL

(1)   Slave video   Radar video: TIY, VD, BP(2048 p), BZ (Terminal board TB4302)

(2)   Navigation information   Send capability Port: .NAV1, NAV2, GPS port at terminal board TB4303.
                                NMEA Connecter at rear of the process unit (D-Sub 9 PIN). IEC61162-1/2

Radar system data:	RSD
Own ship data:	OSD
Tracking target data:	TTM, TLL, TTD, TLB, JRC-ARPA
AIS target data:	TTM, TLL, TTD, TLB
Alarm:	ALR
Auto pilot:	APB
Bearing of destination:	BOD
Latitude/Longitude data:	GGA, GLL, RMC
Waypoint data:	RMB, BWC
COG/SOG data:	VTG
Cross track error:	XTE
Heading data:	HDT, THS

(3)   External alarm   Default setting: normally closed contact
                             Maximum current: 200 mA
                             (SYSALM, ARPAALM port at terminal board TB4303).

(4)   External monitor   Multi scan monitor, Analog RGB, HD15 pin Connector

11.12   STANDARD CONFIGURATION

(1)   Scanner   1

(2)   Display unit   1 (Process unit, LCD Monitor, Operation unit)

(3)   Equipment cable   Display unit to power unit   Standard:10 m
                           Power unit to scanner   Standard:20 m

(4)   Equipment reserve parts   1

(5)   Instruction manual   1 (Japanese or English)

11

11.13 EQUIPMENT DISTANCE BETWEEN OTHER INSTRUMENTS

		Maximum	Standard
(1)	LCD monitor to processor unit	5 m	5 m
(2)	Keyboard unit to processor unit	5 m	5 m
(3)	Power unit to display unit	20 m[*1]	10m
(4)	Scanner to power unit	65 m[*1]	20 m

*1   Total distance between scanner and display unit must be 65 m or less.

11.14 OTHERS (OPTION)

- Coast line ROM card

- Memory card

- Interswitch unit (NQE-3141)

- Rectifier unit (NBA-5111)

- GYRO I/F (NCT-59A)
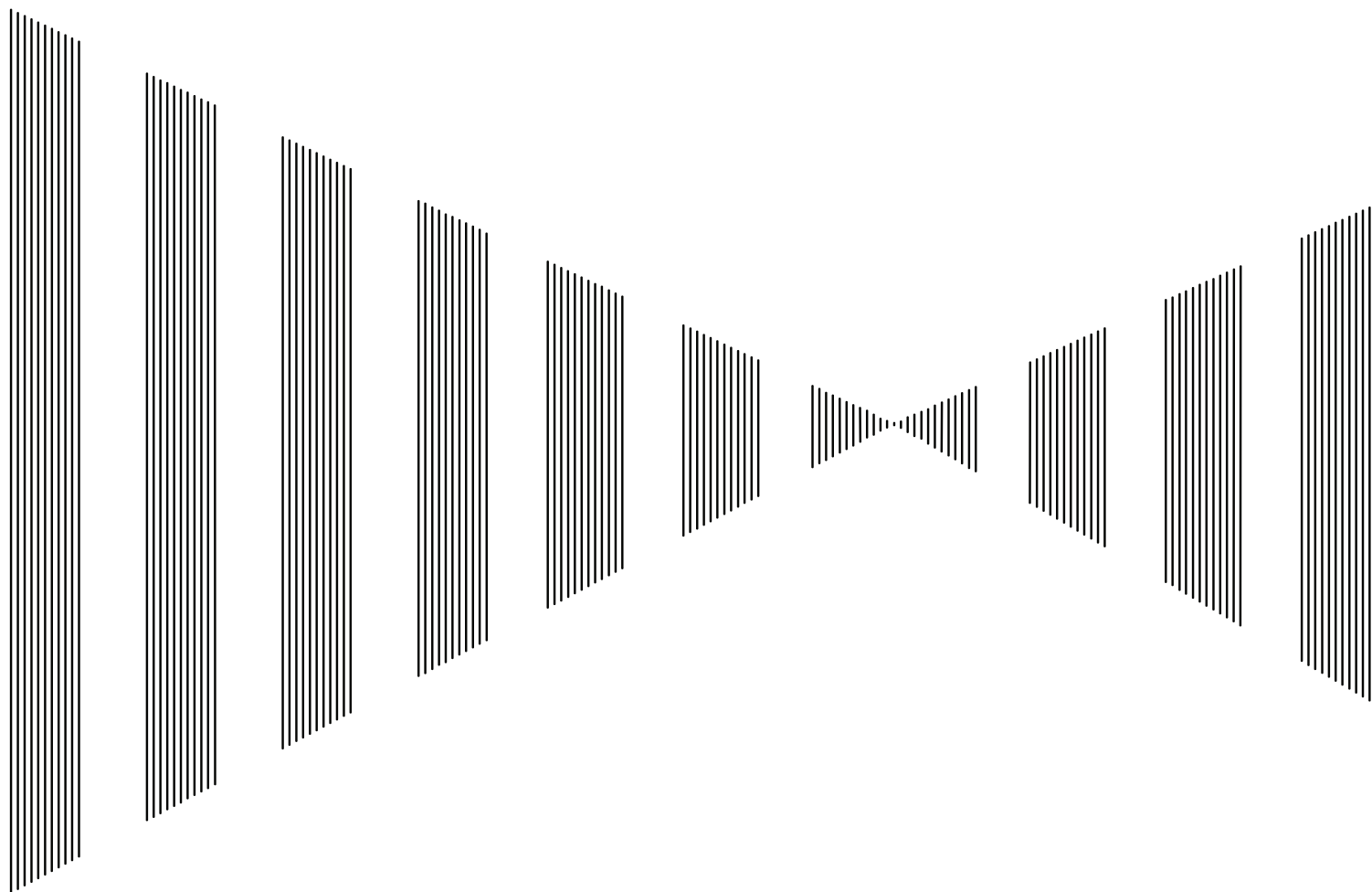
INTERSWITCH (OPTION)
NQE-3141
INSTRUCTION MANUAL

I OVERVIEW

I-i   Overview

Interswitch NQE-3141 is equipment that enables free changeover between radar display units installed on the bridge and antenna units having different characteristics.
If display unit is turned off or malfunctioned, the scanner unit can be controlled by other display unit.
If interswitch unit had malfunctioned, the radar system is switched to standalone mode.
Up to 8 units can be changed over.
When the connected scanner is changed, following setting values are automatically loaded.

Tune Adjustment	(See the section 7.1.3)
Bearing Adjustment	(See the section 7.1.4)
Range Adjustment	(See the section 7.1.5)
Antenna Height	(See the section 7.1.8)
Antenna installation location	(See the section 7.1.9)
Sector Blank	(See the section 7.2.2)
TNI Blank	(See the section 7.2.3)
Performance monitor adjustment	(See the section 7.2.4)
PRF Fine Tuning	(See the section 3.8.3)

I-ii   Interswitch Setup

Connection modes can be changed simply by changing the interswitch connection (upper left of the display ⑥ on page 2-16).

Note: A master display unit is always necessary for establishing a slave connection.
Before a slave display unit can be placed in transmission state, the master display unit must be placed in transmission state.

upper left of the display

⑥ Inter switch connection change

Connected scanner unit name

Connection mode
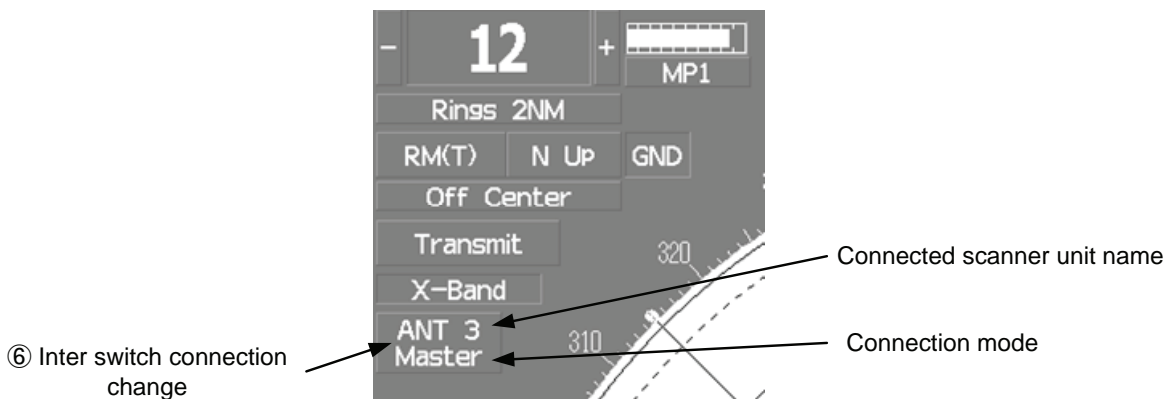
The upper stand indicates the connected scanner unit.
       If scanner unit name is not entered.   :The scanner number is indicated.
       If scanner unit name is entered.   :The scanner name is indicated (Max 6 characters).
For How to names of scanner unit, see the "II-vi Names of display units and scanner units".
The lower stand indicates the connection mode.
       Master   :Mode in which the scanner unit can be controlled by the display unit.
       Slave   :Mode in which the scanner unit cannot be controlled.
When   Slave   is selected, transmission / standby and pulse length cannot be changed.   The available range is also limited.

II INTERSWITCH OPERATION

Follow the flowchart below to change the current interswitch connection pattern.

II-i   Operation Flow

```
┌─────────────────────────────────────────────┐
│                                             │
│      Place the transmission standby state.  │
│                                             │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│                                             │
│         Open the Inter Switch Menu.         │
│                                             │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│                                             │
│        Change the connection pattern.       │
│                                             │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│                                             │
│        Close the Inter Switch Menu.         │
│                                             │
└─────────────────────────────────────────────┘
```

APPENDIX
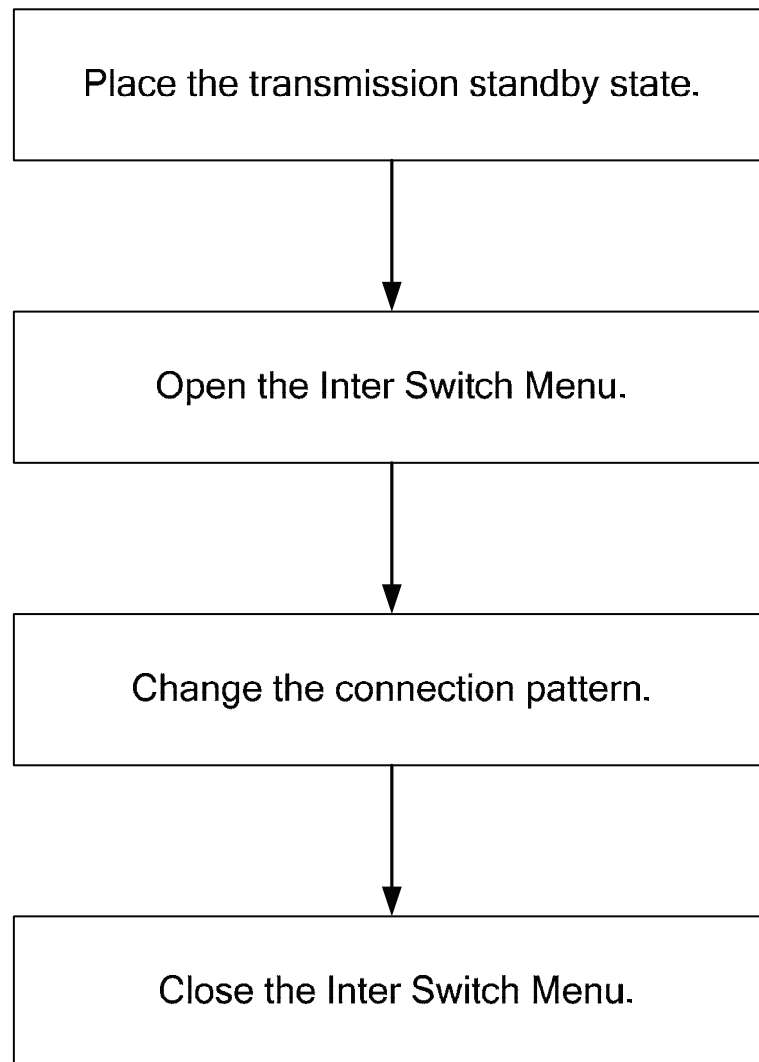
II-ii   Inter Switch Menu

The Inter Switch Menu can be opened only when the transmission standby state.

Procedures   **1   Press the [STBY] key.**

The transmission standby state will be placed.

2   Move the cursor onto the Interswitch connection change (upper left of the display ⑥ on page 2-16), and press the [ENT] key.

The Inter Switch Menu will appear.

Exit   **1   Press the [0] key.**

The Inter Switch Menu will close.

Inter Switch Menu (with 2 Display Units)
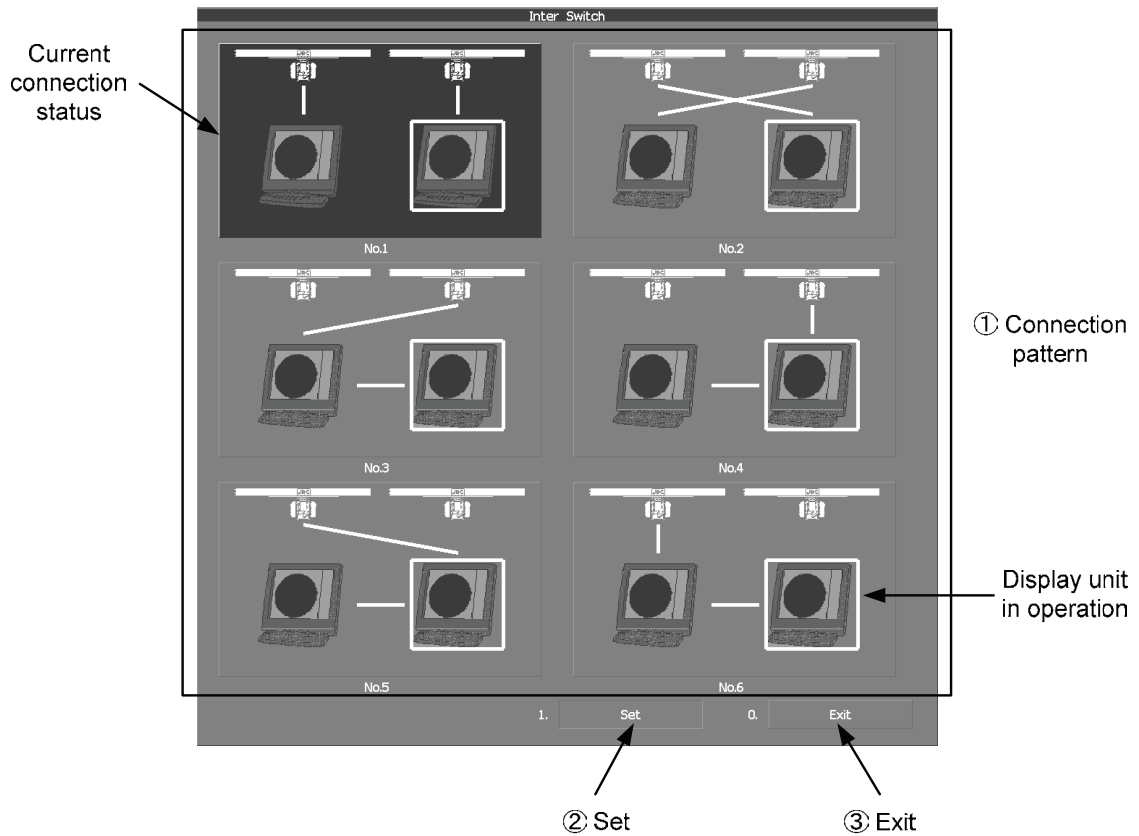
① : **Connection pattern**

> If this button is clicked, the connection pattern is selected.
> The display unit in operation is enclosed in a square □.
> The background of the current connection pattern display is highlighted.

② : **Set**

> If this button is clicked, the change of connection is determined.

③ : **Exit**

> If this button is clicked, the Inter Switch Menu is closed .

Note: If only 2 display units are installed but the interswitch is set for 3 or more display units, the Inter Switch Menu for 3 or more display units will appear.

APPENDIX

Inter Switch Menu (with 3 or More Display Units)
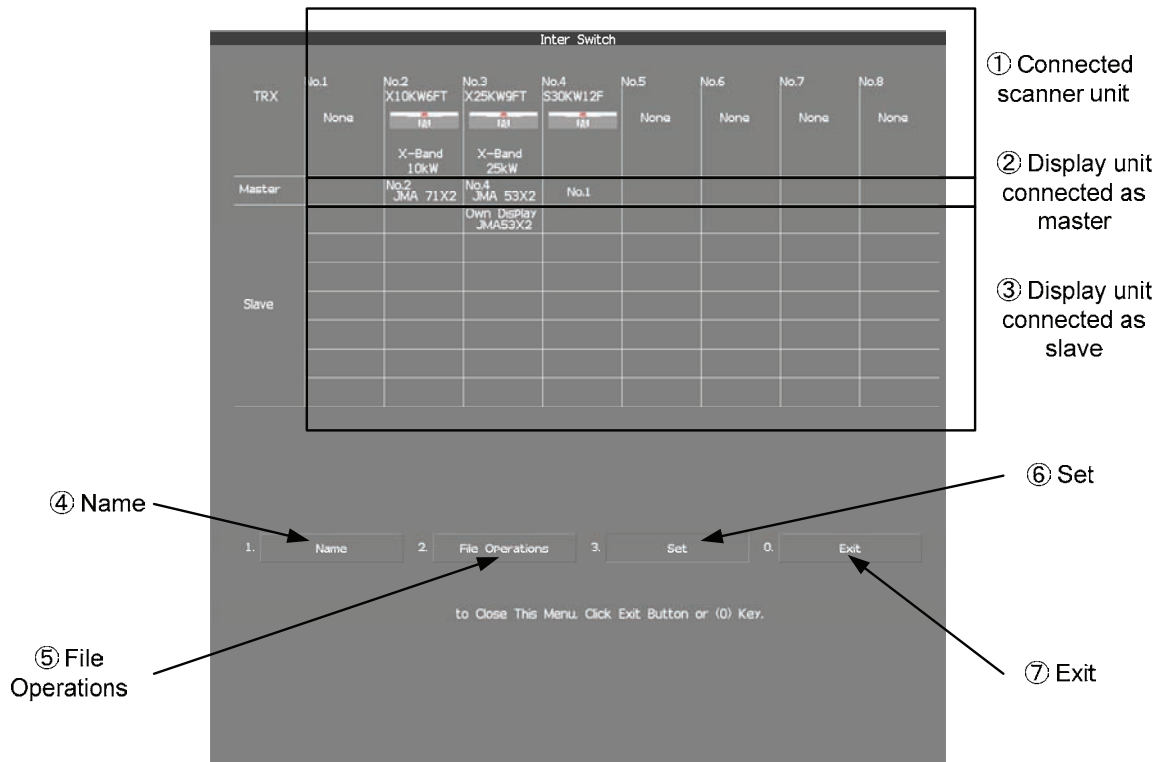
① : **Connected scanner unit**
    In mode for naming a display unit or antenna unit, clicking on a unit opens the name input window.

②, ③ : **Display unit connected as master, and Display unit connected as slave**
    If this button is clicked, select / cancel the display unit.
    If this button is clicked in the naming a display unit or scanner unit mode , the name input window is opened.

④ : **Name**
    If this button is clicked, set to the display or scanner unit rename mode.

⑤ : **File Operations**
    If this button is clicked, the File Operations menu is opened.

⑥ : **Set**
    If this button is clicked, the change of connection is determined.

⑦ : **Exit**
    If this button is clicked, the Inter Switch Menu is closed.

II-iii   Change of Connection Pattern (with 2 Display Units)

If two display units are installed, a connection pattern needs to be selected.

Procedures   **1   Open the Inter Switch menu (with 2 Display Units).**

2   Move the cursor onto the Connection pattern (Inter Switch Menu ① on page A-4) to be changed , and press the [ENT] key.

The connection pattern will be selected, and Set (in Inter Switch Menu ② on page A-4) will blink.

3   Press the [3] key.

The connection pattern will be changed.

II-iv   Change of Connection Pattern (with 3 or More Display Units)

If three or more display units are installed, the layout of connection patterns needs to be set.

Procedures   **1   Open the Inter Switch Menu (with 3 or More Display Units).**

2   Move the cursor onto the display unit (Inter Switch Menu ②/ ③ on page A-5) to be changed , and press the [ENT] key.

The selected display unit will be highlighted.
To deselect the display unit, press the **[ENT]** key again.

3   Move the cursor to the change-destination display unit, and press the [ENT] key.

The selected display unit in step 2 will be switched to the change-destination display unit, and Set (Inter Switch Menu ⑥ on page A-5) will blink.
If the change destination is empty, control will move and Set will blink.

4   Press the [3] key.

The connection pattern will be changed.

<u>**Note:**</u>   A master display unit is always necessary for establishing a slave connection.

II-v Operating Connection Pattern Files (File Operations)

Frequently used connection patterns can be read easily by saving interswitch connection patterns.

[I] Loading connection patterns (Load)

Procedures

1 Open the Inter Switch Menu (with 3 or More Display Units).

2 Press the [2] key.

The File Operations menu will appear.

3 Press the [1] key.

Currently saved connection patterns in memory will be listed.

4 Press the [numeric] key corresponding to the file to be loaded.

Confirmation Window will appear.

5 Press the [1] key.

The connection pattern will be changed.

[II] Saving connection patterns (Save)

Procedures

1 Open the Inter Switch Menu (with 3 or More Display Units).

2 Press [2] key.

The File Operations window will appear.

3 Press [2] key.

The Save menu will appear.
Currently saved connection patterns in memory will be listed.

4 Press the [numeric] key corresponding to the file to be saved.

The Input File Name window will appear.

5 Enter the file name to be saved.

Up to 8 characters can be entered.
For the input method on the character input screen, see Section 3.3.4.
The connection pattern will be saved when the name is input.

[III]   Erasing a connection pattern (Erase)

Procedures

1   Open the Inter Switch Menu (with 3 or More Display Units).

2   Press the [2] key.

The File Operations window will appear.

3   Press the [3] key.

The Erase menu will appear.
The list of connection patterns stored in the memory will be displayed.

4   Press the [numeric] key corresponding to the file to be erased.

Confirmation Window will appear.

5   Press the [1] key.

The selected connection pattern is erased and the file name is deleted from the list.

II-vi   Names of Display Units and Scanner Units

The display units and antenna units can be named.

Procedures

1   Open the Inter Switch Menu (with 3 or More Display Units).

2   Press the [1] key.

"Name" will be highlighted, indicating that the rename mode is activated.

3   Move the cursor to the display unit or scanner unit to be renamed (Inter Switch Menu ① / ② / ③ on page A-5), and press the [ENT] key.

The Input IND Name or the Input TXRX Name window will appear.

4   Input a new unit name.

Up to 8 characters can be input as a unit name.
For the input method on the character input menu, see Section 3.3.4.
The selected display unit or antenna unit will be renamed when the new name is input.
The scanner name is indicated in the interswitch connection change (upper left of the display ⑥ on page 2-16) (Max 6 characters).

APPENDIX

▦ REFERENCE

Preheat Time after Change of Connection Pattern

After the current interswitch connection pattern has been changed, operation needs to wait until the system is ready.   This is because the preheat time varies depending on the previous connection of the scanner unit and display unit.
The wait time is necessary for protecting the electronic tubes that emit radio waves.

a) When not changed to a new connection pattern   : Preheating not required
b) When changed to a new connection pattern and
    an scanner unit had been used before the change   : Preheating not required
c) When changed to a new connection pattern and
    an scanner unit had not been used before the change   : Preheating required

Notes on Changing Connection Pattern

An attempt to change to another connection pattern immediately after the completion of connection pattern change may fail.
This is because internal processing still needs some preparation time upon completion of connection pattern change.   Let several seconds pass between connection pattern change operations.

Notes on Connecting Slave Display Unit

Before a slave display unit can be placed in transmission state, the master display unit must be placed in transmission state.   If the master display unit is moved from the transmission state to the transmission standby state, the slave display unit is forcibly placed in transmission standby state. When they are in transmission standby state,
$\boxed{\text{Master Standby}}$ is shown in the alarm indication (Brilliance / alarm on page 2-9), and the alarm sounds.

A slave display unit cannot control tune.   Tune is controlled by the master display unit. $\boxed{\text{Slave}}$ is shown in the transmitter pulse length (upper left of the display on page 2-2).

Range change for a slave display unit is limited by the range and pulse length / repetition frequency of the master display unit.   As a rule, a greater range than the range of the master display unit cannot be set for a slave display unit.   However, if the transmitter pulse length of a slave display unit is identical to the master display unit's and the repetition frequency is within the master display unit's, a greater range than the master display unit's can be selected for the slave display unit.   When the master display unit narrows the range or changes the transmitter pulse length, the range of the slave display unit may be forcibly changed.   In this case, $\boxed{\text{Master Range}}$ $\boxed{\text{CHG}}$ is shown in the alarm indication (Brilliance / alarm on page 2-9), and the alarm sounds.

Setting at Installation

◎ Setting of the interswitch circuit (CCL-304*)

The settings of the DIP switches SW11 to SW13 are shown below.

SW 11   SW 13   SW 12

Interswitch circuit PCB
CCL-304*
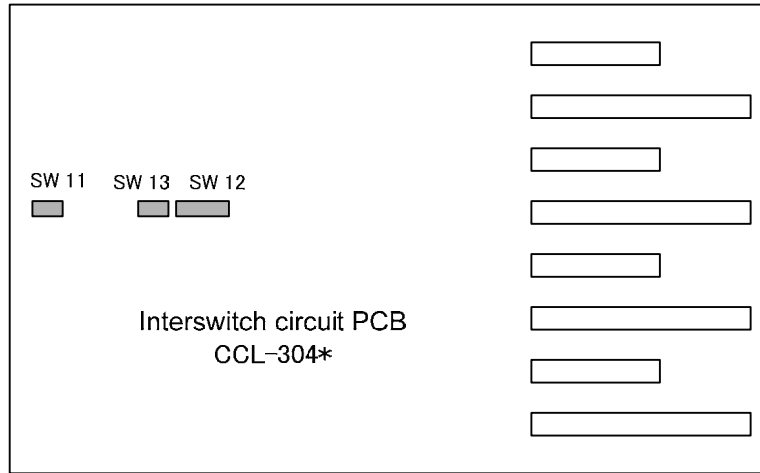
1)   SW11 setting (extension mode and master/slave settings)

```
     1   2   3   4
ON
OFF
```

Extension mode setting

4	Description
ON	Extension mode
OFF	Normal mode

Set the switch to OFF if the number of connected display units is four or less.

Master/slave setting

3	Description
ON	Slave
OFF	Master

Set the switch to ON if the slave ISW PCB is selected in extension mode.

Unused

1, 2	Description
ON	Unused
OFF	Unused

Set the switch to OFF in normal state.

APPENDIX

2) SW12 setting (radar connection settings)

Radar connection settings

	ON	No.1 display unit connected
1	OFF	No.1 display unit not connected
2	ON	No.1 scannerunit connected
	OFF	No.1 scanner unit not connected
3	ON	No.2 display unit connected
	OFF	No.2 display unit not connected
4	ON	No.2 scannerunit connected
	OFF	No.2 scannerunit not connected
5	ON	No.3 display unit connected
	OFF	No.3 display unit not connected
6	ON	No.3 scanner unit connected
	OFF	No.3 scanner unit not connected
7	ON	No.4 display unit connected
	OFF	No.4 display unit not connected
8	ON	No.4 scanner unit connected
	OFF	No.4 scanner unit not connected

3) SW13 (unused)

1,2,3,4	Unused (All OFF)

Note: Before the DIP switches of the interswitch circuit can be set, the interswitch breaker must be turned off in order to ensure safety operation.

HOW TO INSERT AND REMOVE A CARD

Insert or remove the JRC coastline ROM card, ERC card, C-MAP card and memory card according to the procedures below.

Note: Keep a card horizontal when inserting it into a card slot.   An inclined card causes a failure.
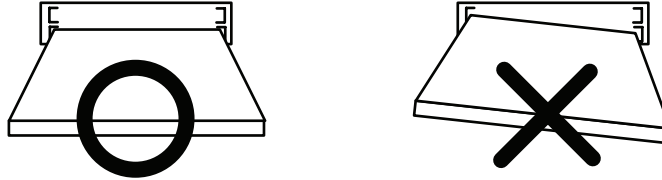
Do not simultaneously insert a JRC coastline ROM card, an ERC card and C-MAP card into the card slot.   A malfunction will occur on the display.

Insert the card into the specified slot according to the following table:

Card type	Insertion slot No.
JRC card	Either one
ERC card	Either one
C-Map NT+ detail card	Either one
Memory card	Either one

Note: The Background of C-Map has been built in, don't insert C-Map NT+ background card. If the background card is inserted, the system will malfunction.

Insert a card into processor unit

Procedures   **1   Remove the rubber packing located at the backside of the processing unit cabinet, and expose the card slot.**

Backside of the processor unit
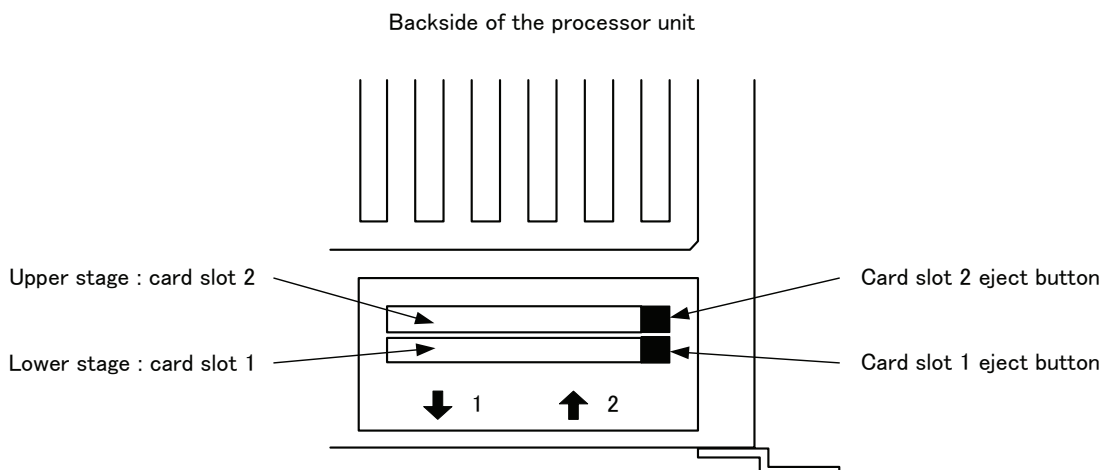
2   Insert the card in the direction indicated by the arrow.

Insert a card into a slot 1/2

JRC Coastline
ROM card

ERC card

PCMCIA(PC-CARD)
type C-MAP card

Compact Flash
Card Adapter

IN

Face

Face

C-MAP NT

Insert a card
into an adapter

Compact Flash
type C-MAP card

Compact Flash
memory card

CompactFlash™
2GB
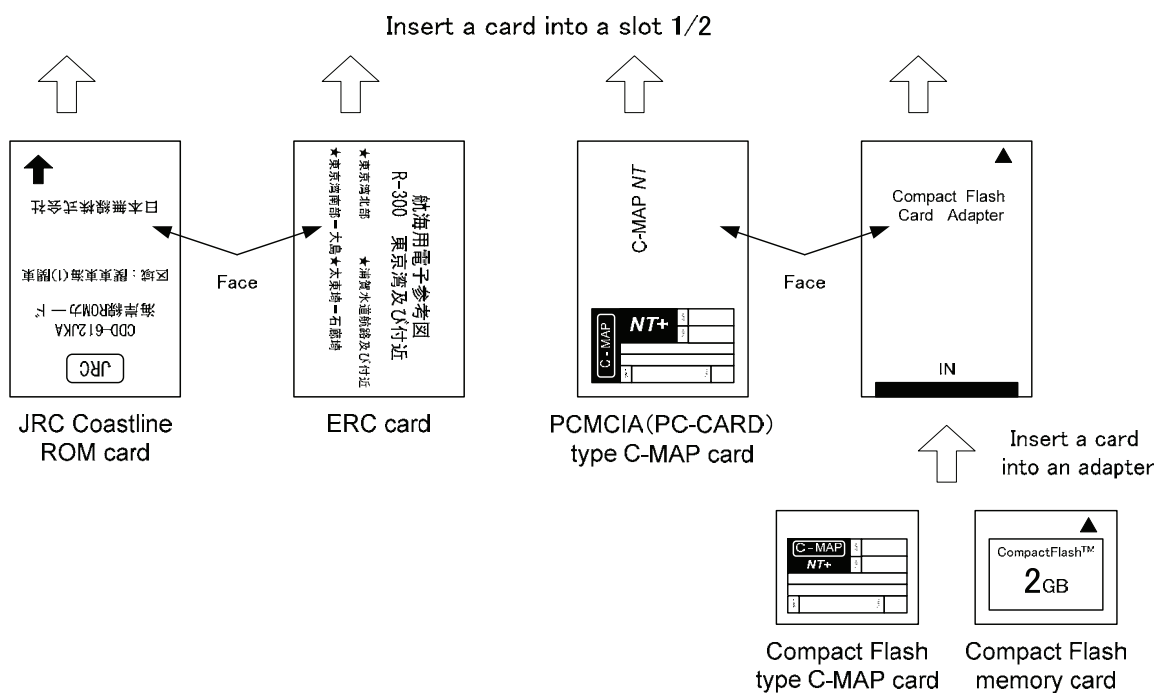
3   Insert the card until the card slot's eject button protrudes and complete the installation of a card.

Eject a card from processor unit

Procedures   **1   Push the eject button corresponding to the desired card slot.**

2   remove a card from processor unit
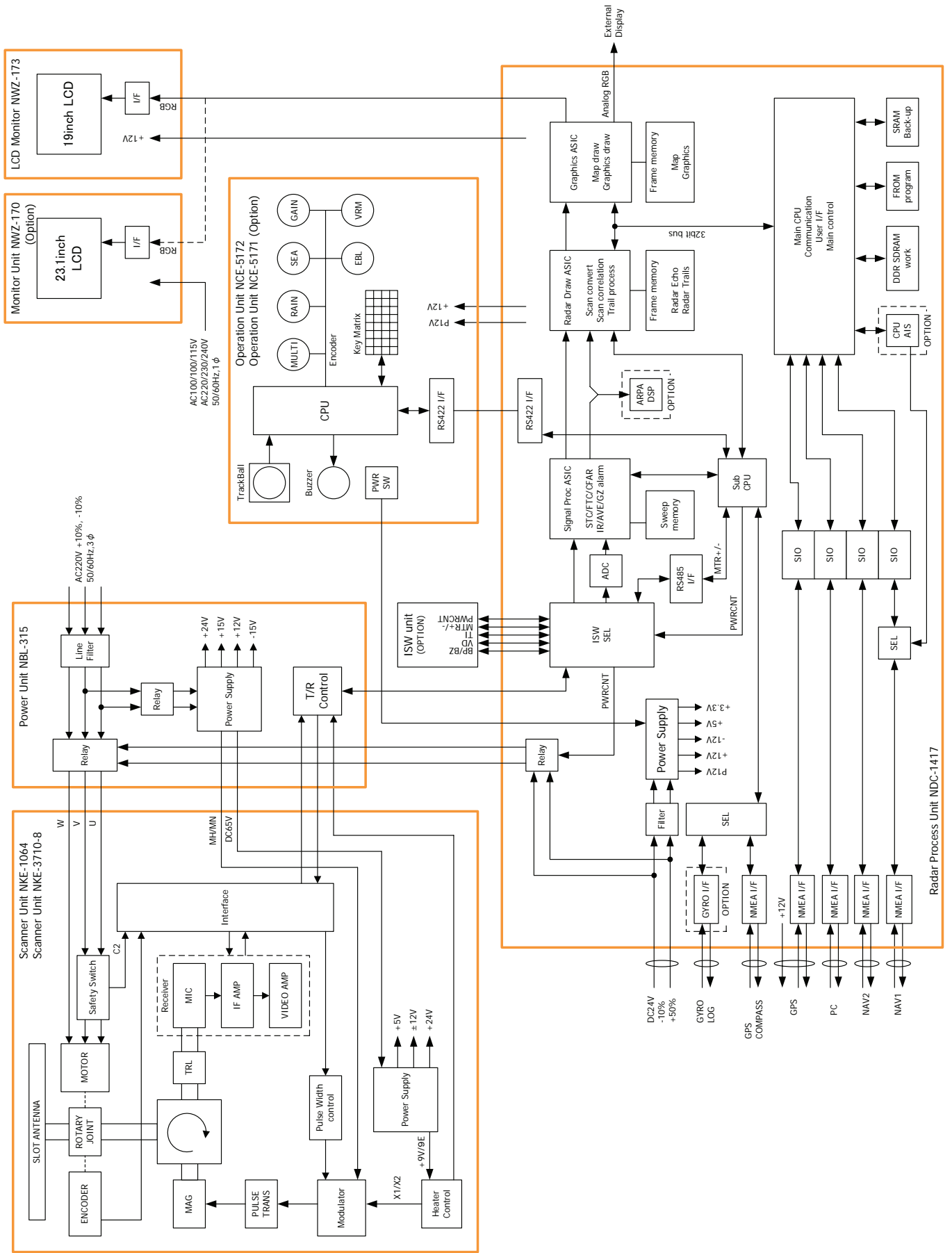
Fig.1 Block Diagram of RADAR Type JMA-5352-9R, JMA-5362-8R

Fig.2 Terminal Board Connection Diagram of RADAR, Type JMA-5352-9R, JMA-5362-8R

Fig.3 Terminal Board Connection Diagram of RADAR and INTERSWITCH Unit, Type NQE-3141 (Option)
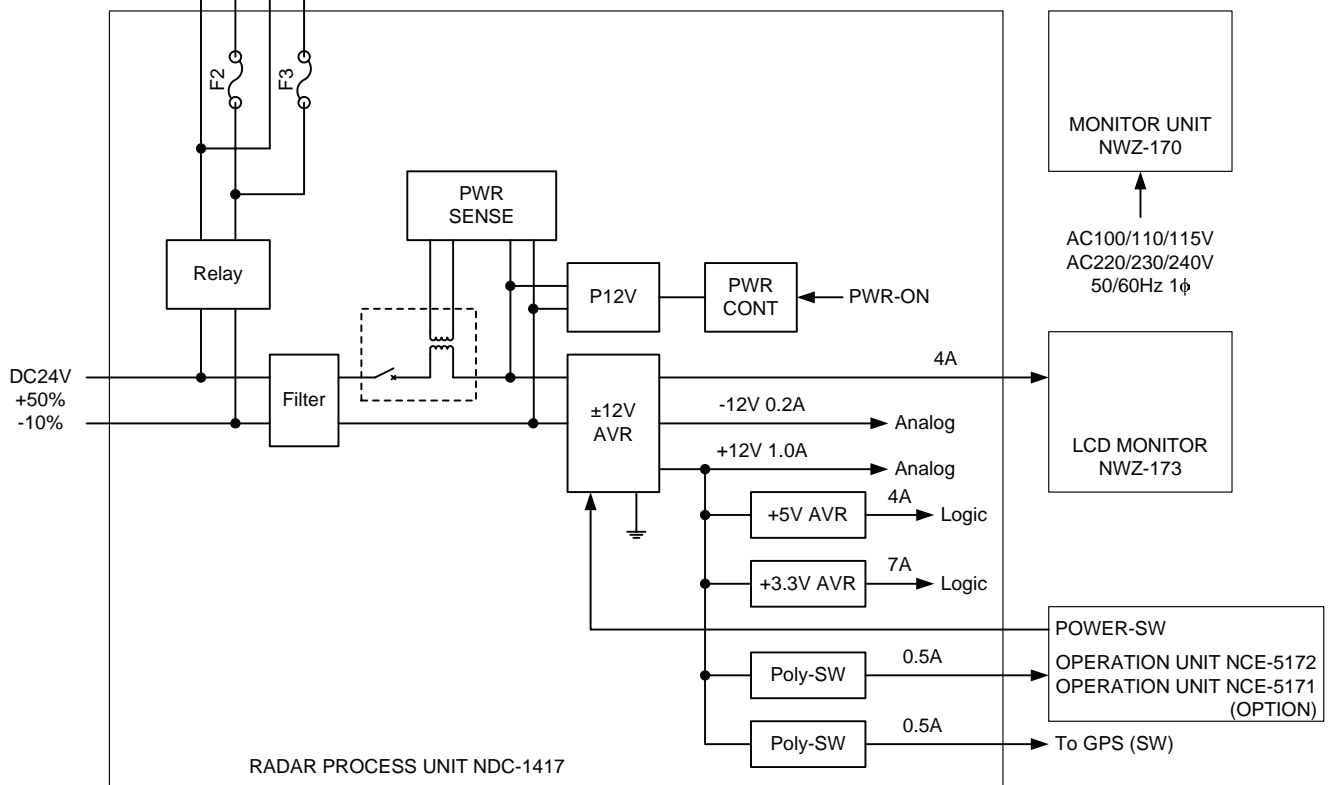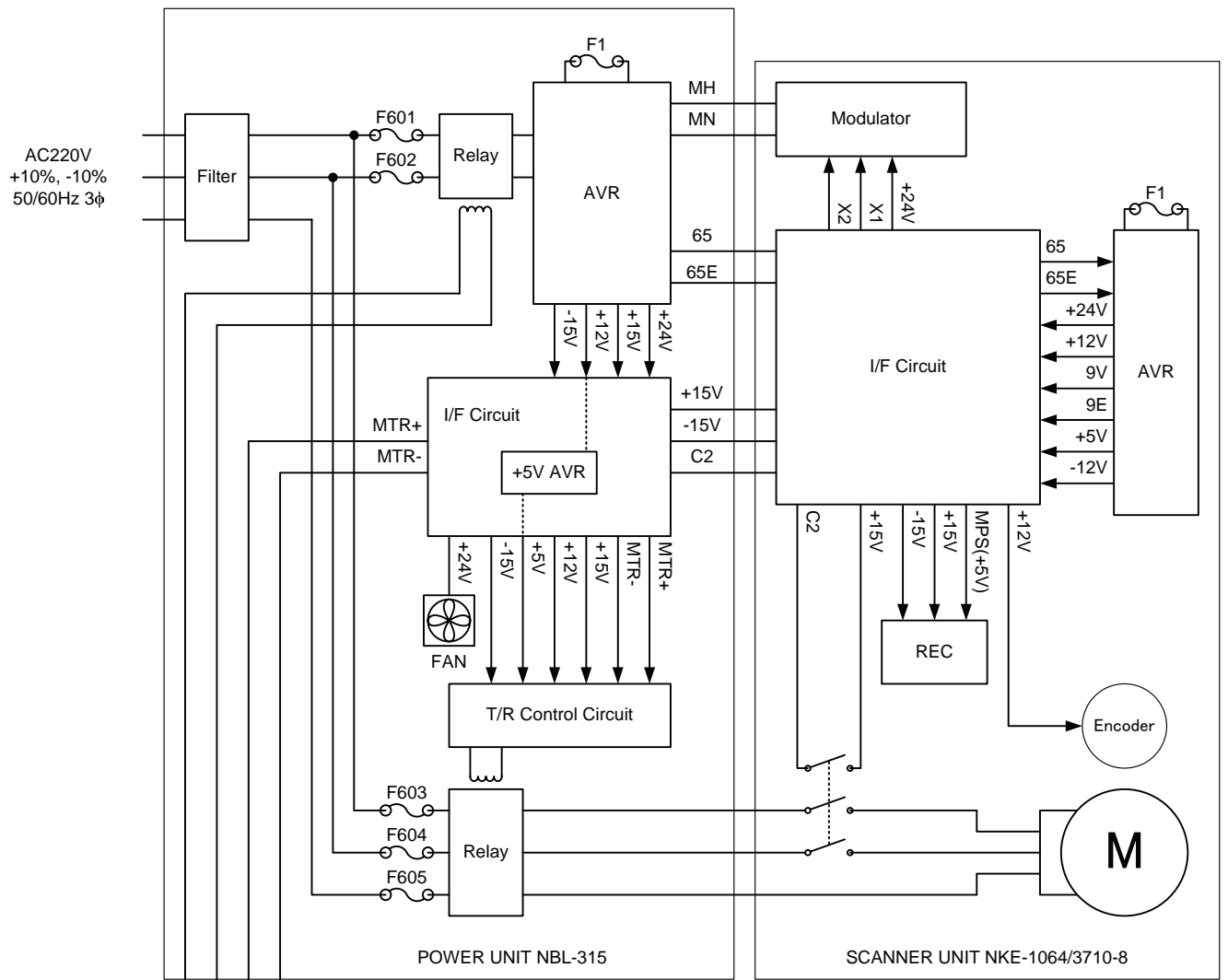
Fig.4 Power System Diagram of RADAR, Type JMA-5352-9R, JMA-5362-8R
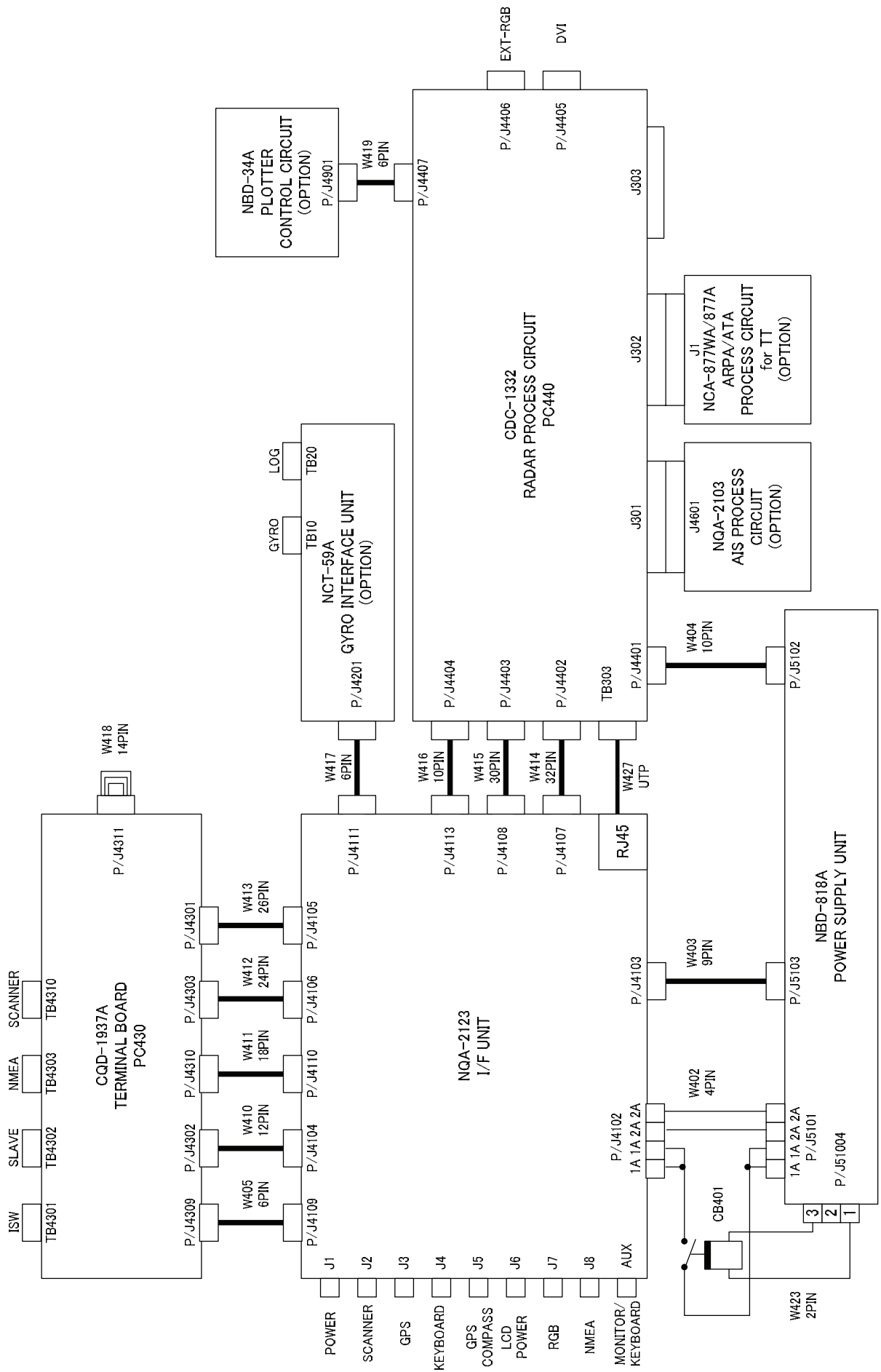
Fig.5 Internal Connection Diagram of RADAR PROCESS UNIT, Type NDC-1417
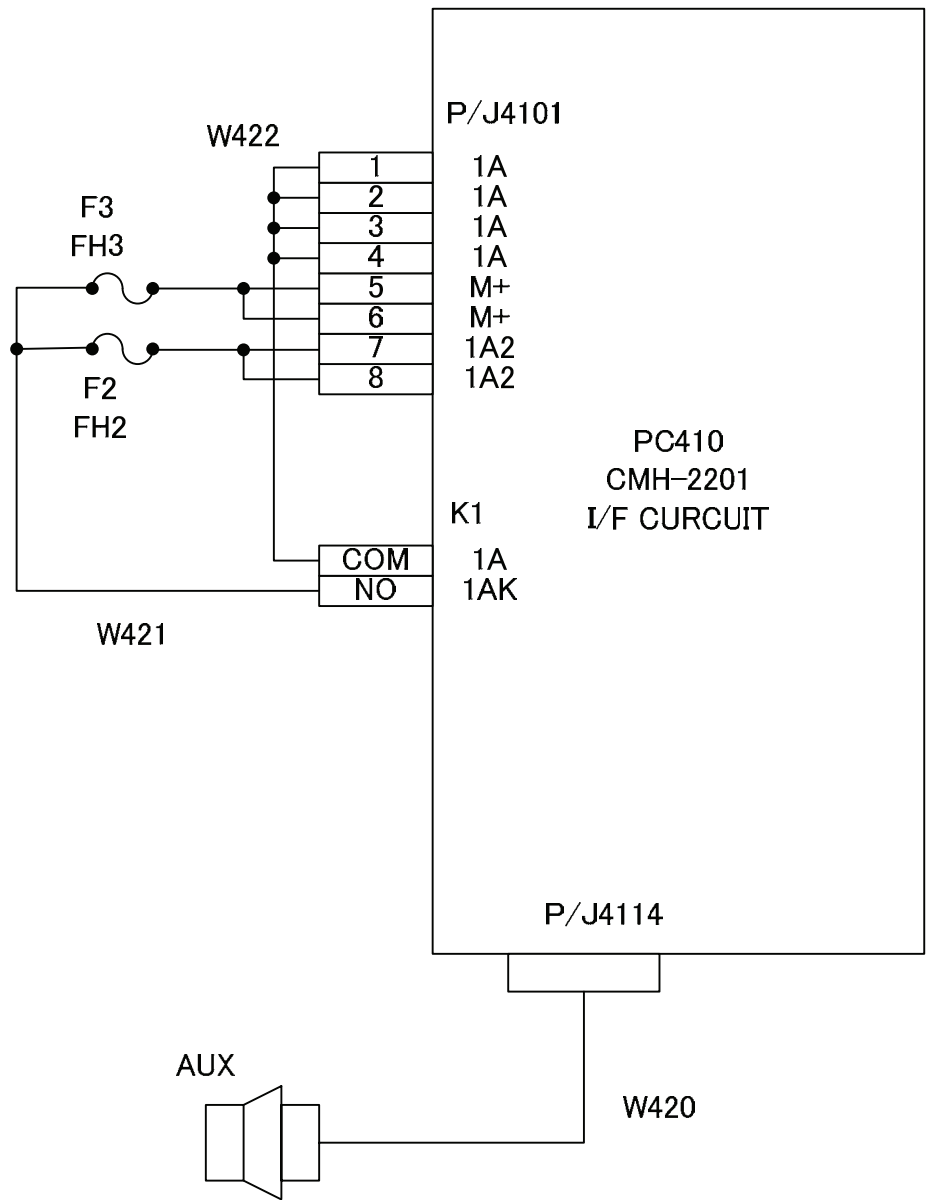
Fig.6 Internal Connection Diagram of INTERFACE UNIT, Type NQA-2123
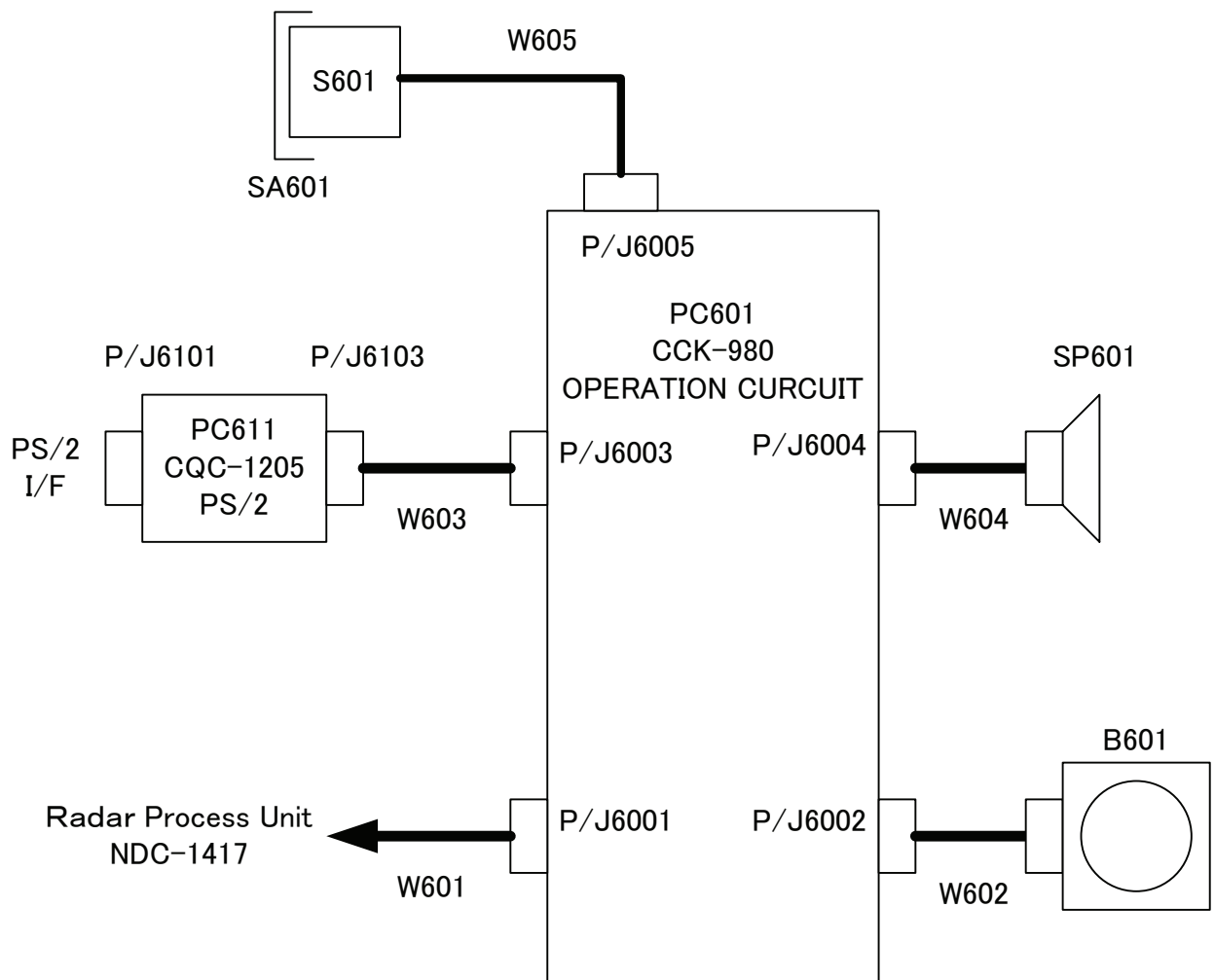
Fig.7 Internal Connection Diagram of OPERATION UNIT, Type NCE-5172
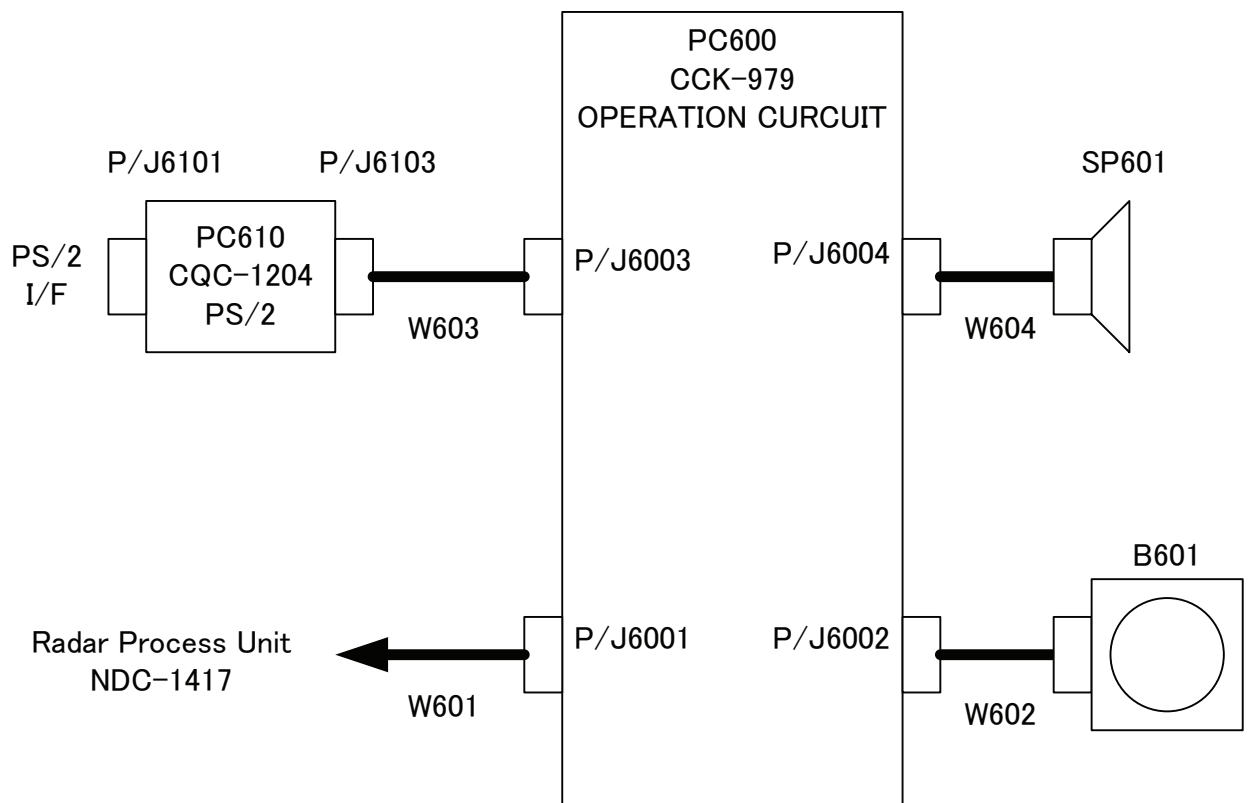
Fig.8 Internal Connection Diagram of OPERATION UNIT, Type NCE-5171 (Option)
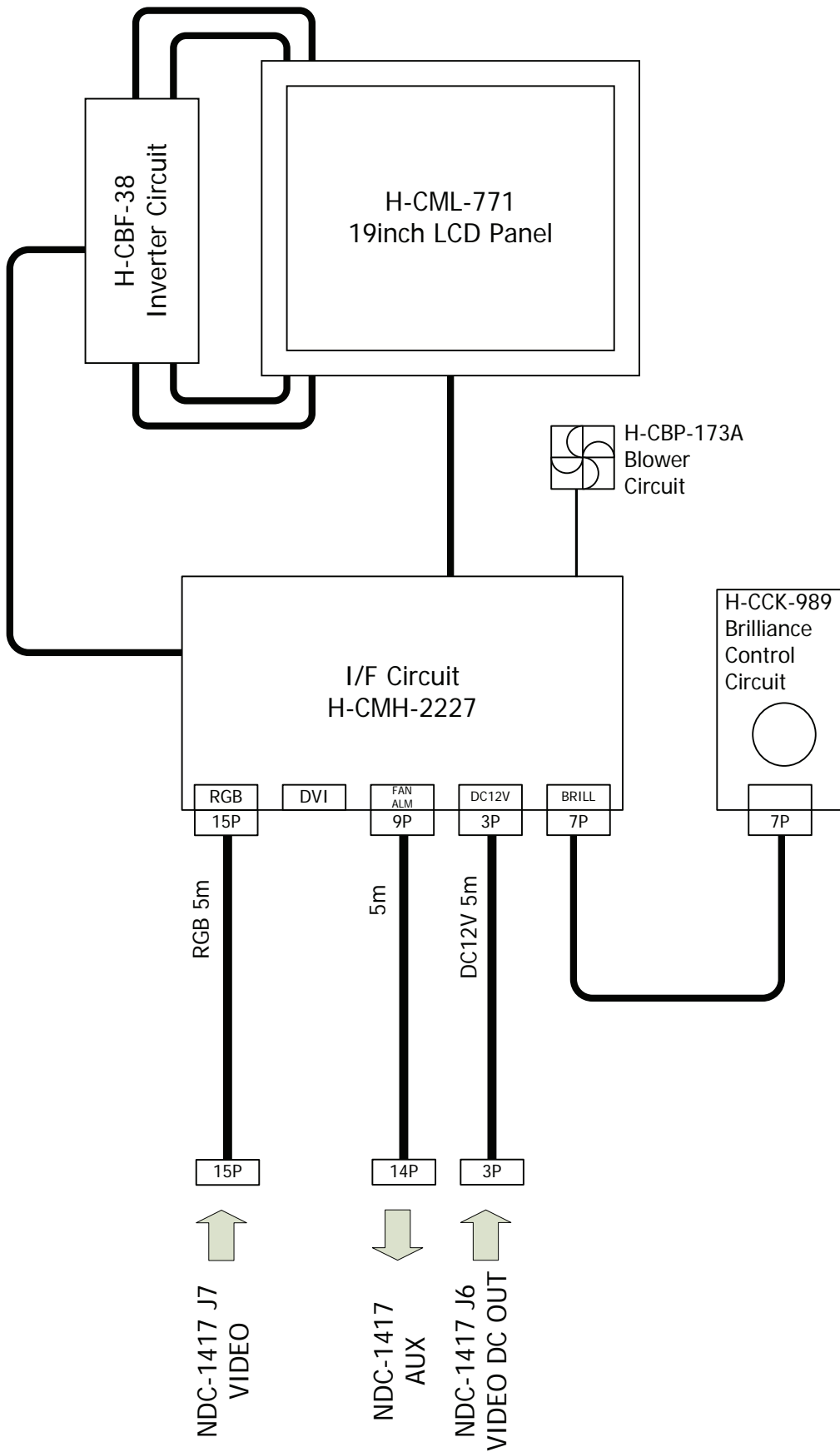
Fig.9 Internal Connection Diagram of LCD MONITOR, Type NWZ-173

H-CML-799
23.1inch LCD

RGB	DVI	FAN ALM	AC100/2 20V	BRILL
15P		9P	3P	8P

H-CCK-972
LCD
Operation
Circuit

8P

RGB 5m

5m

AC 5m

15P

14P

3P

NDC-1417 J7
VIDEO

NDC-1417
AUX

AC100/110/115/220/
230/240V 50/60Hz 1φ
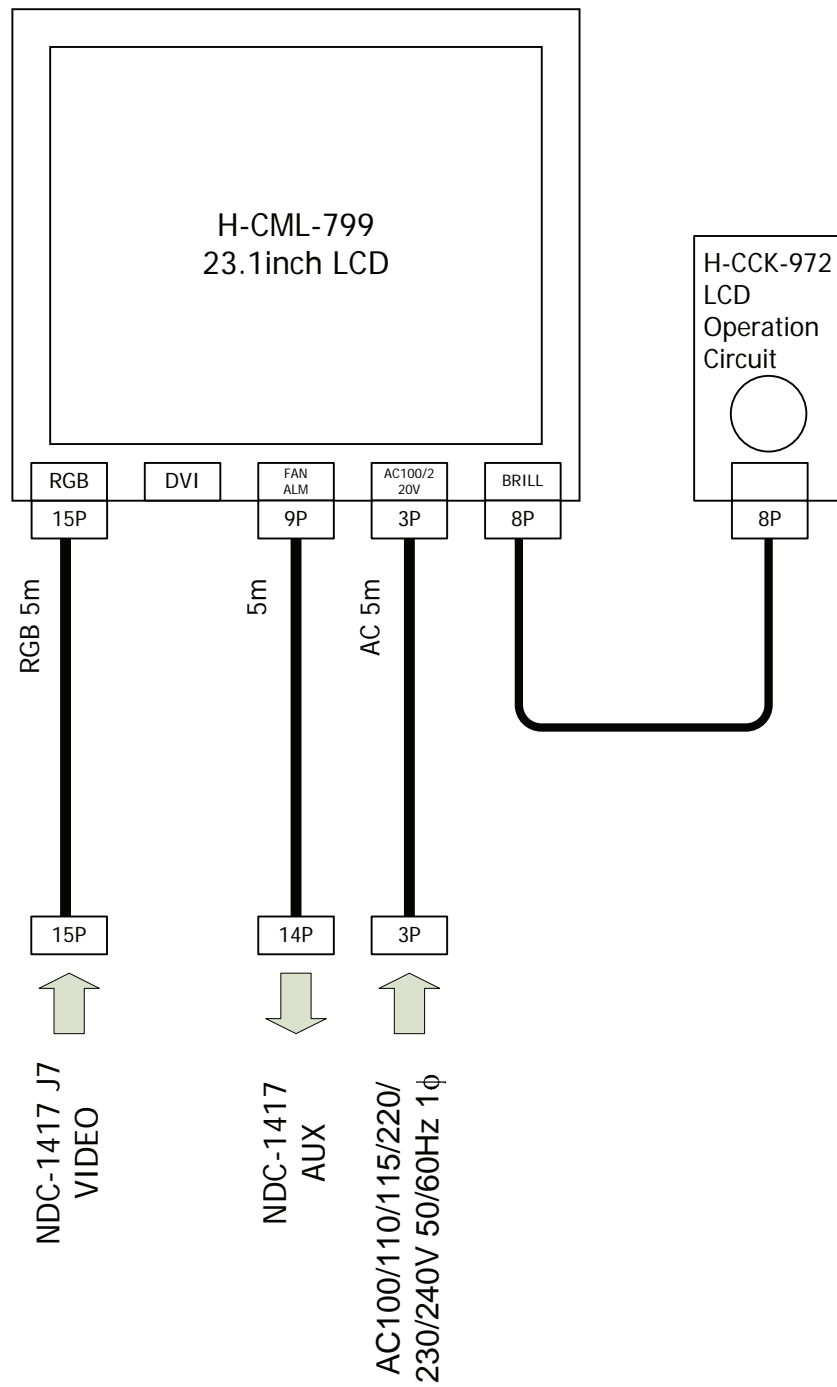
Fig.10 Internal Connection Diagram of MONITOR UNIT, Type NWZ-170 (Option)
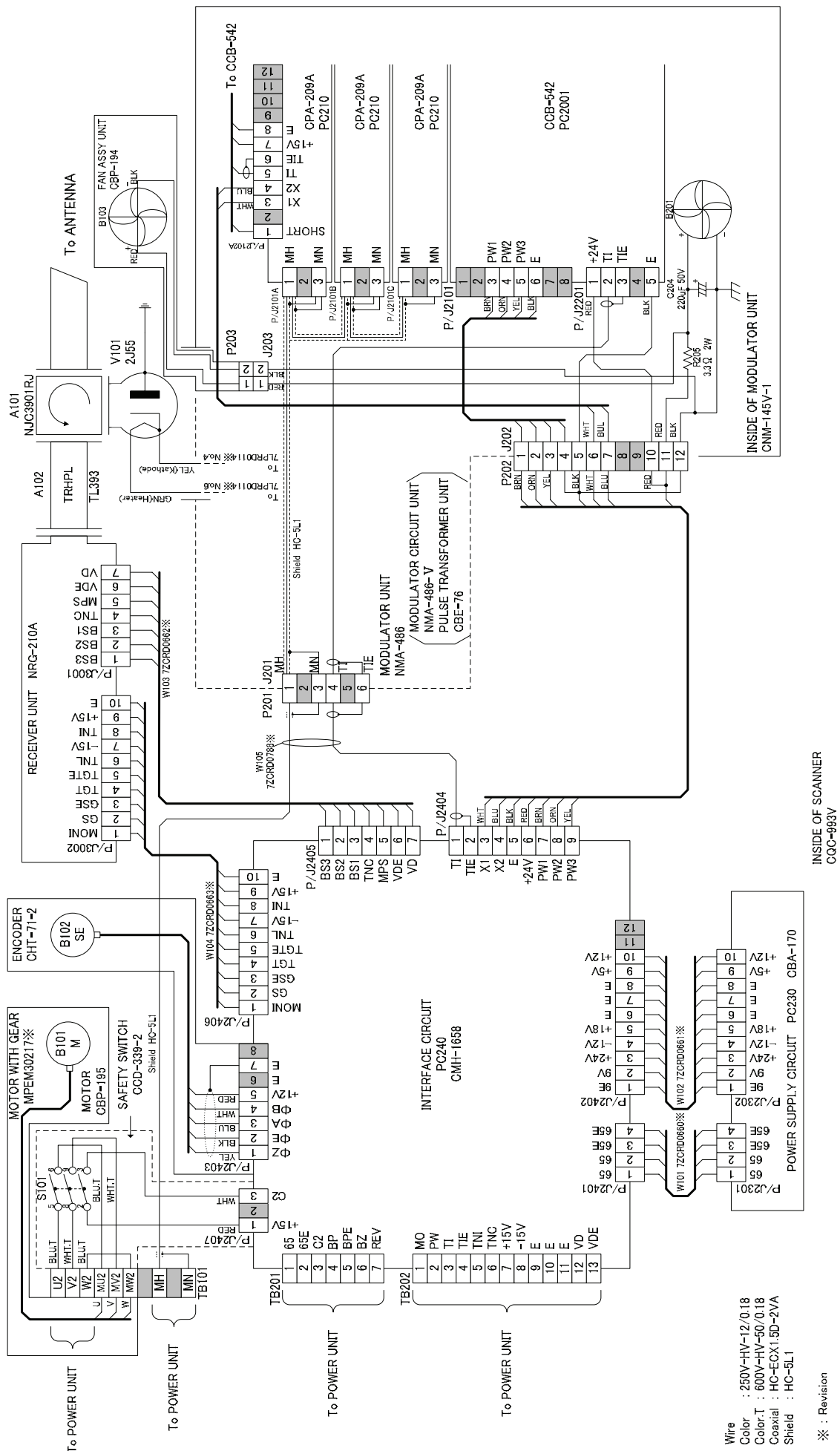
Fig.11 Internal Connection Diagram of SCANNER UNIT, Type NKE-1064
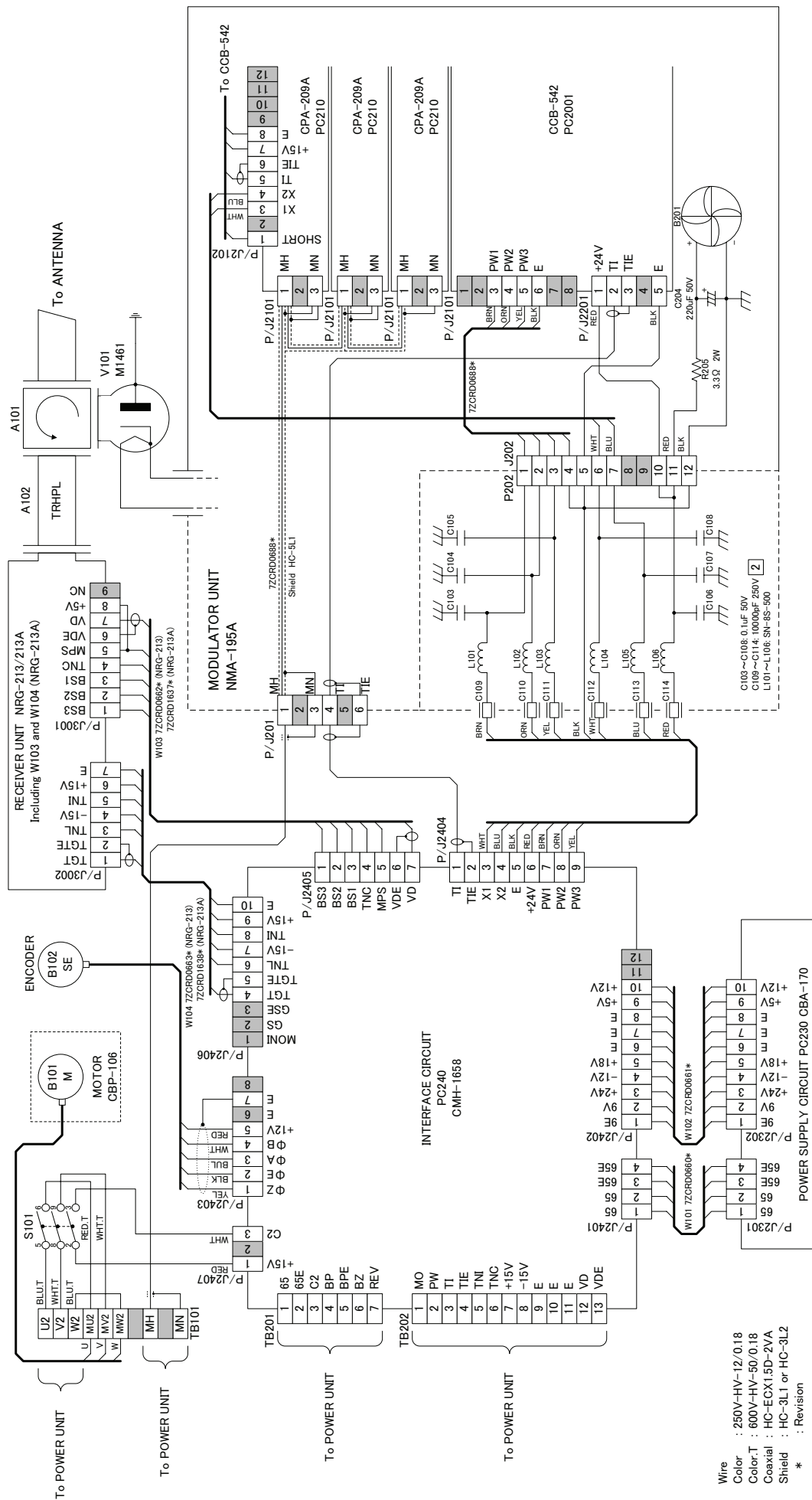
Fig.12 Internal Connection Diagram of SCANKER UNIT, Type NKE-3710-8
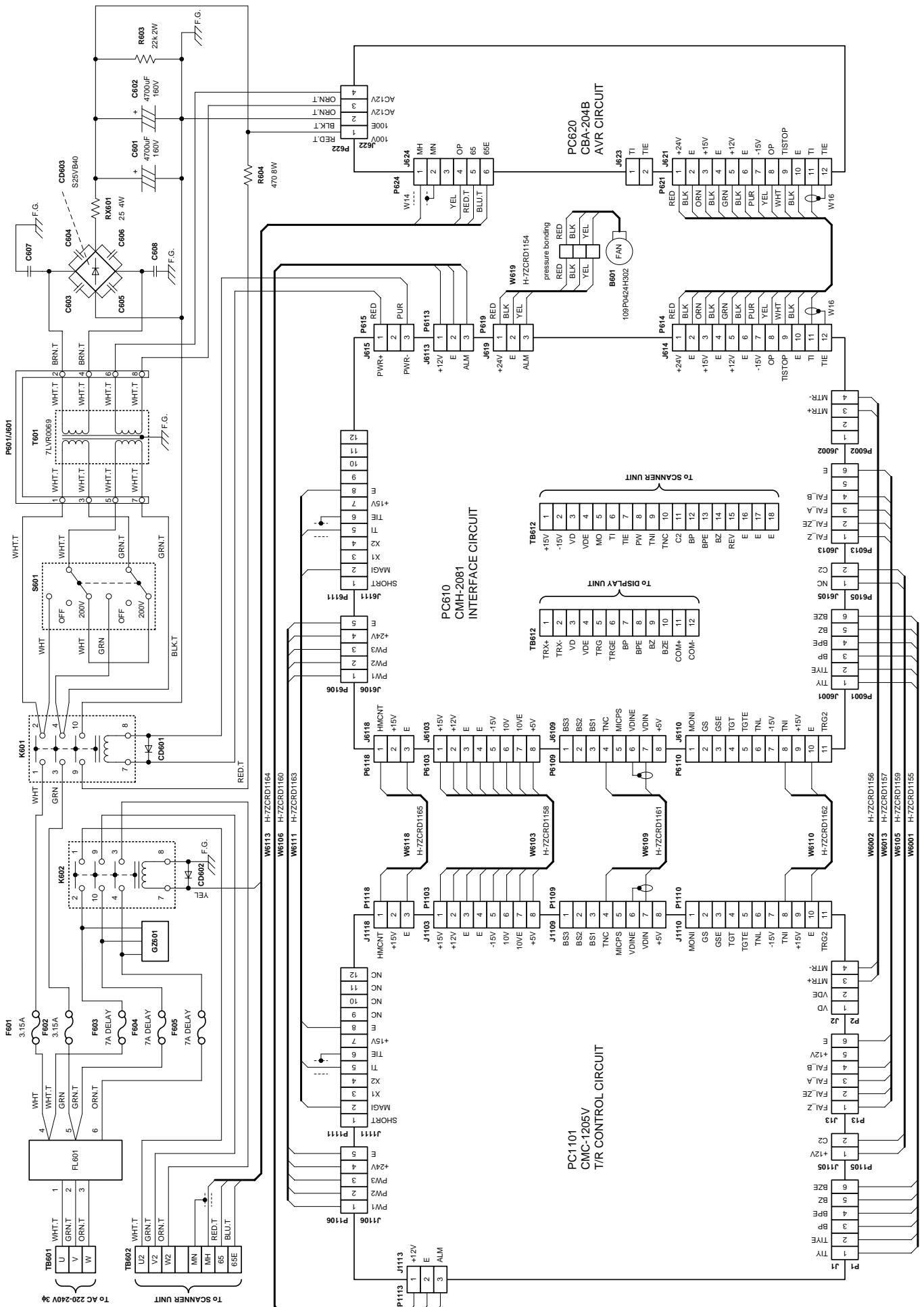
Fig.13 Internal Connection Diagram of POWER UNIT, Type NBL-315
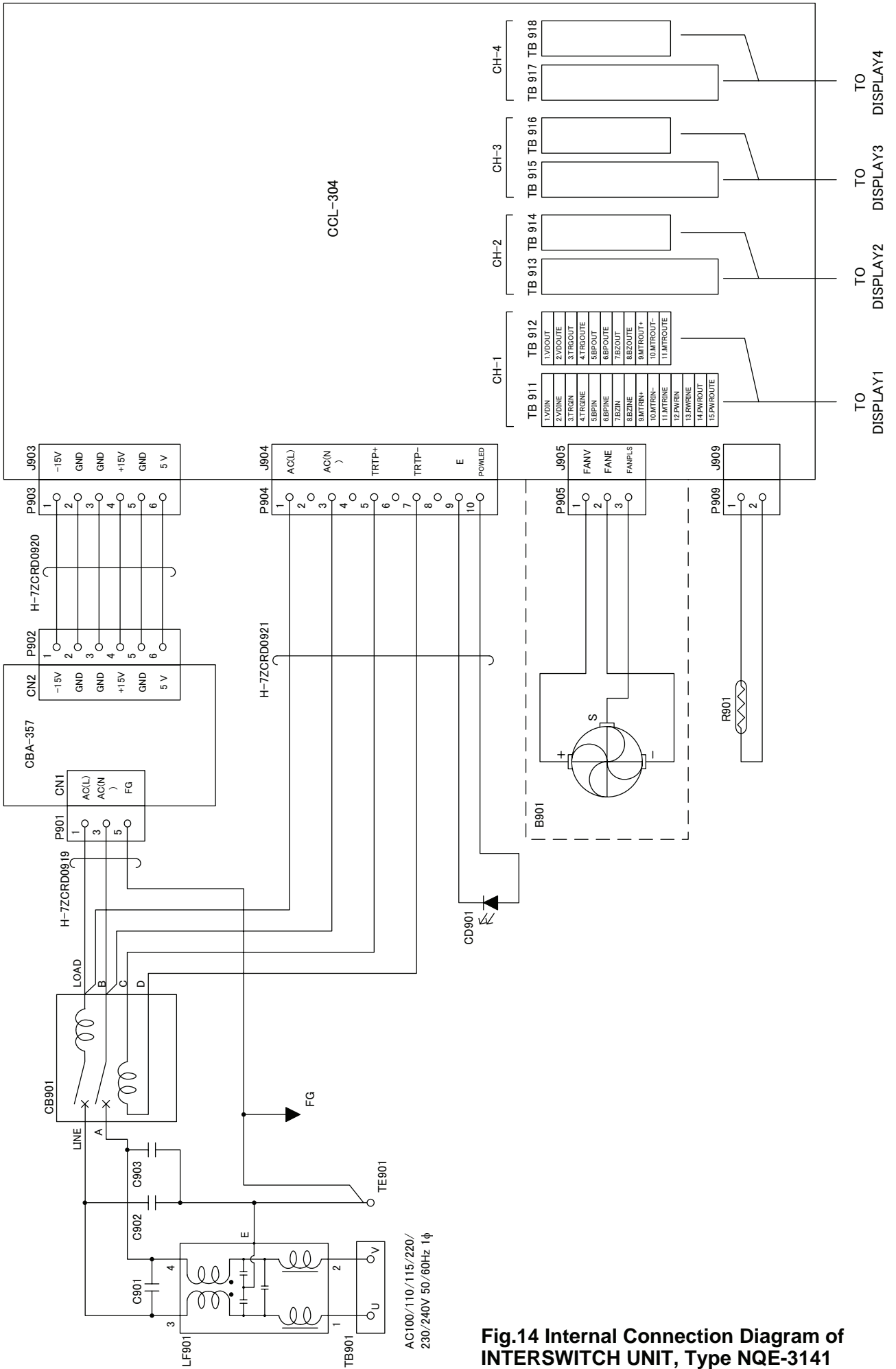
Fig.14 Internal Connection Diagram of INTERSWITCH UNIT, Type NQE-3141 (Option)

Fig.15 Over View of RADAR Menu

With PLOTTER Unit (option)

MAIN MENU(RADAR MENU key)

1 RADAR Trails Setting
- 1 Trails Mode → Section 3.8.2
- 2 Trails Reference Level → Section 3.8.2
- 3 Trails Reduction → Section 3.8.2
- 5 Trails Process → Section 3.8.2
- 6 Max Interval → Section 3.8.2
- 7 Trails Erase
    - 1 Trails Erase Mode → Section 3.4.9
    - 2 Trails Erase Start → Section 3.4.9
    - 3 Eraser Size → Section 3.4.9
- 8 File Operations
    - 1 Select Card Slot → Section 3.4.10
    - 2 Load → Section 3.4.10
    - 3 Save → Section 3.4.10
    - 4 Erase → Section 3.4.10

2 Map Setting
- 1 Fill Land Area → Section 3.12.4
- 2 C-MAP Setting
    - 1 LAT/LON Line Display → Section 3.12.6
    - 2 Depth Display → Section 3.12.6
    - 3 Depth Unit → Section 3.12.6
    - 4 Light Sectors Display → Section 3.12.6
    - 5 Light Sectors Level → Section 3.12.6
    - 6 Chart Boundary → Section 3.12.6
    - 7 Buoy&Beacon → Section 3.12.6
    - 8 Names → Section 3.12.6
    - 9 Next
        ↓
    - 1 Land Marks → Section 3.12.6
    - 2 River&Lake → Section 3.12.6
    - 3 Cultual → Section 3.12.6
    - 4 Bottom Type → Section 3.12.6
    - 5 Under Water → Section 3.12.6
    - 6 Depth Contour → Section 3.12.6
- 3 JRC/ERC Setting
    - 1 Day/Night → Section 3.12.5
    - 2 Color of Land → Section 3.12.5
    - 3 Bright of Land → Section 3.12.5
    - 4 Color of Sea → Section 3.12.5
    - 5 Bright of Sea → Section 3.12.5
    - 6 Color of Name → Section 3.12.5
    - 7 Bright of Name → Section 3.12.5
    - 8 Bright of Track/Mark/Line → Section 3.12.5
    - 9 Next
        ↓
    - 1 LAT/LON Line → Section 3.12.5
    - 2 Color of L/L Line → Section 3.12.5
    - 3 Bright of L/L Line → Section 3.12.5
    - 4 ERC Display Request → Section 3.12.5
    - 5 ERC Mark → Section 3.12.5
    - 6 JRC ROM Card Display
        - 1 Lighthouse → Section 3.12.5
        - 2 Buoy → Section 3.12.5
        - 3 Rough Line → Section 3.12.5
        - 4 Other Line → Section 3.12.5
    - 7 Copy JRC ROM Card to CF → Section 3.12.3
    - 8 Fishing Area Display
- 4 Contour Setting
    - 1 10m → Section 3.12.5
    - 2 20m → Section 3.12.5
    - 3 30m → Section 3.12.5
    - 4 40m → Section 3.12.5
    - 5 50m → Section 3.12.5
    - 6 60m → Section 3.12.5
    - 7 70m → Section 3.12.5
    - 8 80m → Section 3.12.5
    - 9 Other → Section 3.12.5
- 5 Map Display Setting
    - 1 Shift Coast Line 1 → Section 3.12.7
    - 2 Shift Coast Line 2 → Section 3.12.7
    - 3 LAT/LON Correction → Section 3.12.7
    - 4 Map Center Position → Section 3.12.7
    - 5 LORAN C Correction
        - 1 Chain
        - 2 TD1
        - 3 TD2
        - 4 TD1 Correction
        - 5 TD2 Correction
    - 6 LORAN A Correction
        - 1 LOP1
        - 2 LOP2
        - 3 TD1 Correction
        - 4 TD2 Correction
    - 7 DECCA Correction
        - 1 Chain
        - 2 LOP1
        - 3 LOP2
        - 4 LOP1 Correction
        - 5 LOP2 Correction
- 6 SEL JRC ROM Card File → Section 3.12.3
- 7 Map Draw AZI Mode → Section 3.12.8
- 8 JRC Card Draw Mode → Section 3.12.5

3　TOOL Menu

1　PI　Menu

1	Display for All Lines	→ Section 4.1.5
2	Operation Mode	→ Section 4.1.5
3	Control	→ Section 4.1.5
4	Floating	→ Section 4.1.5
5	Heading Link	→ Section 4.1.5
6	Next	
	PI Bearing	
	Interval	

The setting items are determined by the setting of Operation Mode

All :
Individual :
Track :
Equiangular :

8	Press EBL Dial to Control PI#
9	Press VRM Dial to Move End Point#

Displayed only when "Control" is Individual.

↓

1	Range Scale Link	→ Section 4.1.5
2	Reference Bearing	→ Section 4.1.5
3	Operation Area	→ Section 4.1.5
4	Display for Individual Line	
	PI Bearing	
	Interval	

The setting items are determined by the setting of Operation Mode

All :
Individual :
Track :
Equiangular :

1	Index Line 1	→ Section 4.1.5
2	Index Line 2	→ Section 4.1.5
3	Index Line 3	→ Section 4.1.5
4	Index Line 4	→ Section 4.1.5
5	Index Line 5	→ Section 4.1.5
6	Index Line 6	→ Section 4.1.5
7	Index Line 7	→ Section 4.1.5
8	Index Line 8	→ Section 4.1.5

8	Press EBL Dial to Control PI#
9	Press VRM Dial to Move End Point#

Displayed only when "Control" is Individual.

2　Rectangle Cursor

1	Rectangle Cursor Display
2	Make Rectangle Cursor
3	Ent
4	Unit of Distance

3　EBL Maneuver Setting

1	EBL Maneuver	→ Section 4.1.6
2	Reach	→ Section 4.1.6
3	Turn Mode	→ Section 4.1.6
4	Turn Set	→ Section 4.1.6

4　Trial Maneuver

1	Trial Function	→ Section 5.7
2	Course(EBL)	→ Section 5.7
3	Speed(VRM)	→ Section 5.7
4	Vector Time	→ Section 5.7
5	Time to Maneuver	→ Section 5.7
6	Own Ship's Dynamic Trait	

1	Reach	→ Section 5.7
2	Turn Radius	→ Section 5.7
3	Acceleration	→ Section 5.7
4	Deceleration	→ Section 5.7

4　TARGET TRACK Setting (T.TRK)

1	Target Track Function	→ Section 5.6.2
2	Target Track Color	

1	All	→ Section 5.6.2
2	Target Track No.1	→ Section 5.6.2
3	Target Track No.2	→ Section 5.6.2
4	Target Track No.3	→ Section 5.6.2
5	Target Track No.4	→ Section 5.6.2
6	Target Track No.5	→ Section 5.6.2
7	Target Track No.6	→ Section 5.6.2
8	Target Track No.7	→ Section 5.6.2
9	Next	

↓

1	Target Track No.8	→ Section 5.6.2
2	Target Track No.9	→ Section 5.6.2
3	Target Track No.10	→ Section 5.6.2
4	Other	→ Section 5.6.2

3　Target Track Display

1	All	→ Section 5.6.2
2	Target Track No.1	→ Section 5.6.2
3	Target Track No.2	→ Section 5.6.2
4	Target Track No.3	→ Section 5.6.2
5	Target Track No.4	→ Section 5.6.2
6	Target Track No.5	→ Section 5.6.2
7	Target Track No.6	→ Section 5.6.2
8	Target Track No.7	→ Section 5.6.2
9	Next	

↓

1	Target Track No.8	→ Section 5.6.2
2	Target Track No.9	→ Section 5.6.2
3	Target Track No.10	→ Section 5.6.2
4	Other	

4	Track Memory Interval	→ Section 5.6.2
5	Clear Track Color	→ Section 5.6.2
6	Clear Track Number	→ Section 5.6.2
7	File Operations	

1	Select Card Slot	→ Section 5.6.2
2	Load Mode	→ Section 5.6.2
3	Load	→ Section 5.6.2
4	Save	→ Section 5.6.2
5	Erase	→ Section 5.6.2
6	Card T.TRK Display	→ Section 5.6.2

MAIN MENU(RADAR MENU key)

5 AZ Menu	—	1 AZ 1	→ Section 5.2.1
		2 AZ 2	→ Section 5.2.1
		3 Make AZ	— 1 Make AZ 1 → Section 5.2.1
			2 Make AZ 2 → Section 5.2.1
			3 ENT

4 RADAR Alarm — 1 Sector RADAR Alarm — 1 Sector Alarm 1 → Section 3.4.24
   2 Sector Alarm 2 → Section 3.4.24

3 Make Sector Alarm — 1 Sector Alarm 1 → Section 3.4.24
   2 Sector Alarm 2 → Section 3.4.24
   3 ENT

5 RADAR Alarm Mode → Section 3.4.24
6 Sensitivity Level → Section 3.4.24

5 Set AZ Key — 1 AZ — 1 AZ 1 → Section 5.2.1
   2 AZ 2 → Section 5.2.1

2 Sector RADAR Alarm — 1 Sector Alarm 1 → Section 3.4.24
   2 Sector Alarm 2 → Section 3.4.24

---

6 Own Track Menu (O.TRK) — 1 DISP Own Track → Section 3.5.1

1 DISP Own Track Color — 1 All
   2 White
   3 Cyan
   4 Blue
   5 Green
   6 Yellow
   7 Pink
   8 Red

2 Clear Own Track → Section 3.5.4

2 Clear Own Track Color
3 Track Type
4 Num/Vector Display

5 File Operations — 1 Select Card Slot → Section 3.5.5
   2 Load Mode → Section 3.5.5
   3 Load → Section 3.5.5
   4 Save → Section 3.5.5
   5 Erase → Section 3.5.5
   6 Card Own Track Display → Section 3.5.5

6 Water Depth Setting — 1 Depth setting (MIN)
   2 Depth setting
   3 Depth setting
   4 Depth setting
   5 Depth setting
   6 Depth setting (MAX)

7 Water TEMP. Setting — 1 Temperature setting (MIN)
   2 Temperature setting
   3 Temperature setting
   4 Temperature setting
   5 Temperature setting
   6 Temperature setting (MAX)

8 Current Setting — 1 Current Size
   2 Layer A
   3 Layer B
   4 Layer C

7 PLOT Menu

— **1 Mark Setting**

— **1 Display Mark Type**

1	All	→ Section 3.6.2
2	○	→ Section 3.6.2
3	△	→ Section 3.6.2
4	▽	→ Section 3.6.2
5	□	→ Section 3.6.2
6	◇	→ Section 3.6.2
7	wreck (mark)	→ Section 3.6.2
8	△△	→ Section 3.6.2
9	Next	

↓

1	▽▽	→ Section 3.6.2
2	△▽	→ Section 3.6.2
3	▽△	→ Section 3.6.2
4	＋	→ Section 3.6.2
5	×	→ Section 3.6.2
6	Y	→ Section 3.6.2
7	hand drum (mark)	→ Section 3.6.2
8	light house (mark)	→ Section 3.6.2
9	Next	

↓

1	trapezoid(mark)	→ Section 3.6.2
2	filled trapezoid(mark)	→ Section 3.6.2
3	hat(mark)	→ Section 3.6.2
4	●●	→ Section 3.6.2
5	●	→ Section 3.6.2
6	filled triangle(mark)	→ Section 3.6.2
7	！	→ Section 3.6.2
8	anchor(mark)	→ Section 3.6.2
9	Next	

↓

1	slash-anchor(mark)	→ Section 3.6.2
2	circle-dotted line(mark)	→ Section 3.6.2
3	non-dangerous wreck(mark)	→ Section 3.6.2
4	◎	→ Section 3.6.2
5	mariner's event mark(mark)	→ Section 3.6.2
6	·	→ Section 3.6.2
7	wavy line (mark)	→ Section 3.6.2
8	solid line (mark)	→ Section 3.6.2
9	Next	

↓

1	dashed-dotted line (mark)	→ Section 3.6.2

— **2 Display Mark Color**

1	All	→ Section 3.6.2
2	White	→ Section 3.6.2
3	Cyan	→ Section 3.6.2
4	Blue	→ Section 3.6.2
5	Green	→ Section 3.6.2
6	Yellow	→ Section 3.6.2
7	Pink	→ Section 3.6.2
8	Red	→ Section 3.6.2

— **3 File Operations**

1	Select Card Slot	→ Section 3.6.6
2	Load Mode	→ Section 3.6.6
3	Load	→ Section 3.6.6
4	Unload	→ Section 3.6.6
5	Save	→ Section 3.6.6
6	Erase	→ Section 3.6.6
7	Card Mark Display	→ Section 3.6.6

4 Select Mark Size → Section 3.6.2
5 Comment Font Size → Section 3.6.2

— **2 Mark Operations**

1 Own Ship Position → Section 3.6.3
2 Edit User Map

— **1 Make with Cursor**

1	Type	→ Section 3.6.1
2	Color	→ Section 3.6.1

— **2 Make with L/L**

1	Type	→ Section 3.6.1
2	Color	→ Section 3.6.1
3	L/L	→ Section 3.6.1
4	Comment	→ Section 3.6.1
5	Enter	→ Section 3.6.1
9	New Line Input	→ Section 3.6.1
	⇔	
	New Mark Input	→ Section 3.6.1

3	Move	→ Section 3.6.3
4	Delete	→ Section 3.6.3
5	Insert/Move Vertex	→ Section 3.6.3
6	Delete Vertex	→ Section 3.6.3
7	Delete by Type by Color	→ Section 3.6.3

3 Shift → Section 3.6.5
4 Shift Clear → Section 3.6.5
5 Mark/Line Entry → Section 3.6.4
6 Mark/Line List → Section 3.6.4
7 Geodetic → Section 3.6.7

MAIN MENU(RADAR MENU key)

7 **PLOT Menu** —

3 WPT/Route Settig
（Route Type：Plotter）
—
1 Waypoint Alarm
2 Route Alarm
3 Set Route Sequence
4 Select Route
5 Waypoint Entry
6 Waypoint Input
7 Save Temporary Route
8 Cross Track Limit Line
9 Next
↓
1 Select WPT Mark Size
2 Waypoint Vector
3 Status of Origin/DEST
4 WPT Number Display
5 RTE Number Display

4 WPT/Route Operation
—
1 Route Sequence
2 Waypoint Switch Mode
3 Waypoint Skip
4 Waypoint Back Skip
5 Set/Cancel Waypoint

5 Clear Memory
—
1 Clear Mark/Line Data → Section 3.6.2
2 Clear WPT/Route Data

6 Plot Setting
—
1 Scale/Course Up Setup
—
1 Scale
2 Preset Scale
3 Course Up Data
—
1 Tolerance
2 Averaging
3 Round Speed

2 Current Position Display
3 Cursor Vector DISP
4 Cursor HL Length
5 Scalebar Display
6 AUTO Backup

7 NMEA Waypoint Display → Section 3.7.1

9 Next

Press RADAR MENU again

1 File Manager → Section 3.11.1

2 RADAR Menu
—
1 Process Setting
—
1 Video Latitude → Section 3.8.1
2 Video Noise Rejection → Section 3.8.1
3 AUTO Dynamic Range → Section 3.8.1
4 Process Switch → Section 3.8.1
5 2nd Process Mode → Section 3.8.1
6 Process Switch Range → Section 3.8.1
7 Fast Target Detection → Section 3.8.1
8 User Function Setting
—
1 Function1 Setting
—
1 Mode → Section 3.9.3
2 IR → Section 3.9.3
3 Process → Section 3.9.3
4 Target Enhance → Section 3.9.3
5 AUTO Sea/Rain → Section 3.9.3
6 Save Present State → Section 3.9.3
9 Next
↓
1 Pulse Length 0.75nm → Section 3.9.3
2 Pulse Length 1.5nm → Section 3.9.3
3 Pulse Length 3/4nm → Section 3.9.3
4 Pulse Length 6/8nm → Section 3.9.3
5 Pulse Length 12nm → Section 3.9.3
6 Pulse Length 16nm → Section 3.9.3
9 Next
↓
1 Video Latitude → Section 3.9.3
2 Video Noise Rejection → Section 3.9.3
3 AUTO Dynamic Range → Section 3.9.3
4 Process Switch → Section 3.9.3
5 2nd Process Mode → Section 3.9.3
6 Process Switch Range → Section 3.9.3
7 Fast Target Detection → Section 3.9.3
9 Next
↓
1 Trails Interval → Section 3.9.3
2 Trails Mode → Section 3.9.3
3 Trails Reference Level → Section 3.9.3
4 Trails Reduction → Section 3.9.3
5 Time/All Combine → Section 3.9.3
6 Trails Process → Section 3.9.3
7 Max Interval → Section 3.9.3
9 Next → Section 3.9.3
↓
1 Gain Offset → Section 3.9.3
2 PRF → Section 3.9.3
3 Small Buoy Detection → Section 3.9.3
4 Fishnet Detection → Section 3.9.3
5 Antenna Height → Section 3.9.3
8 Set Mode Default → Section 3.9.3
9 Initialize → Section 3.9.3

2 Function2 Setting → Section 3.9.3
3 Function3 Setting → Section 3.9.3
4 Function4 Setting → Section 3.9.3

9 SART → Section 6.5

MAIN MENU(RADAR MENU key)
-> Press RADAR MENU again

2 RADAR Menu	— 3 TXRX Setting	1 PRF Fine Tuning → Section 3.8.3
		2 Stagger Trigger → Section 3.8.3
		4 PRF
		5 Ice Class Standby Mode → Section 3.8.3

3 Multi Window Setting — 1 DIR/DIST EXP Display → Section 3.8.8
2 Numeric NAV INFO → Section 3.8.8
3 Depth Graph Setting — 1 Depth Graph Display → Section 3.8.8
2 Depth Range → Section 3.8.8
3 Time Range → Section 3.8.8
4 Depth Unit → Section 3.8.8

4 Wind Graph — 1 Wind Graph Display → Section 3.8.8
2 Wind Speed Unit → Section 3.8.8

5 TEMP Graph Setting — 1 TEMP Graph Display → Section 3.8.8
2 TEMP Graph Color → Section 3.8.8
3 TEMP Range — 1 Temperature setting (MIN) → Section 3.8.8
2 Temperature setting → Section 3.8.8
3 Temperature setting → Section 3.8.8
4 Temperature setting → Section 3.8.8
5 Temperature setting → Section 3.8.8
6 Temperature setting (MAX) → Section 3.8.8
4 Time Range → Section 3.8.8

6 Course Bar Setting — 1 Course Bar Display → Section 3.8.8
2 Autopilot Course → Section 3.8.8
3 ROT Scale → Section 3.8.8

4 NAV Equipment Setting — 1 GYRO Setting → Section 3.4.16 → Section 7.1.7
2 MAG Compass Setting — 1 Heading Correction → Section 3.4.18
2 Correct Value → Section 3.4.18

3 Set/Drift Setting — 1 Correction → Section 3.4.19
2 Set → Section 3.4.19
3 Drift → Section 3.4.19

4 GPS Setting — 1 GPS Process Setting — 1 Position → Section 3.4.20
2 Exclusion → Section 3.4.20
3 Geodetic → Section 3.4.20
4 Antenna Height → Section 3.4.20
5 Fix Mode → Section 3.4.20
6 DOP Level → Section 3.4.20
7 Position Average → Section 3.4.20
8 Master Reset → Section 3.4.20
9 Send Data → Section 3.4.20

2 DGPS Setting — 1 Mode → Section 3.4.21
2 Frequency → Section 3.4.21
3 Baud Rate(BPS) → Section 3.4.21
4 DGPS Mode → Section 3.4.21
5 Send Data → Section 3.4.21

3 SBAS Setting — 1 Mode → Section 3.4.22
2 Ranging → Section 3.4.22
3 NG SBAS → Section 3.4.22
4 SBAS Select Mode → Section 3.4.22
5 SBAS No. → Section 3.4.22
6 Send Data → Section 3.4.22

4 GPS Status → Section 3.4.23

5 Weather INFO Setting — 1 Display Weather INFO
2 SEL Observation Place
3 RX Message Display
4 RX Buzzer

5	Sub Menu	—	1	Display Color Setting	—	1	Day/Night	→ Section 3.8.5
						2	Outer PPI	→ Section 3.8.5
						3	Inner PPI	→ Section 3.8.5
						4	Character	→ Section 3.8.5
						5	RADAR Video	→ Section 3.8.5
						6	RADAR Trails(Time)	→ Section 3.8.5
						7	RADAR Trails(All)	→ Section 3.8.5
						8	Target Symbol	→ Section 3.8.5
						9	Next	→ Section 3.8.5

↓

1	Cursor	→ Section 3.8.5
2	Range Rings	→ Section 3.8.5
3	EBL/VRM/PI	→ Section 3.8.5
4	Own Symbol/HL/Vector	→ Section 3.8.5

2	Brilliance Setting	—	1	RADAR Video	→ Section 3.8.5
			2	RADAR Trails	→ Section 3.8.5
			3	Target Symbol	→ Section 3.8.5
			4	Range Rings	→ Section 3.8.5
			5	EBL/VRM/PI	→ Section 3.8.5
			6	Character	→ Section 3.8.5
			7	Own Symbol/HL/Vector	→ Section 3.8.5
			8	Keyboard	→ Section 3.8.5

3	User Setting	—	1	Load User Setting	→ Section 3.10.2
			2	Save User Setting	→ Section 3.10.1
			3	Delete User Setting	→ Section 3.10.3

4	User Key Setting	—	1	User Key 1	→ Section 3.8.7
			2	User Key 2	→ Section 3.8.7

5	Buzzer Volume	—	1	Key ACK	→ Section 3.8.6
			2	OPE Miss	→ Section 3.8.6
			3	CPA/TCPA Alarm	→ Section 3.8.6
			4	New Target Alarm	→ Section 3.8.6
			5	Lost Alarm	→ Section 3.8.6
			6	Navigation Alarm	→ Section 3.8.6
			7	System Alarm	→ Section 3.8.6
			8	Inter Switch	→ Section 3.8.6

6	Date/Time Setting	—	1	UTC/LMT	→ Section 7.2.7
			2	LMT Date	→ Section 7.2.7
			3	LMT Time	→ Section 7.2.7
			4	Time Zone	→ Section 7.2.7
			5	Display Style	→ Section 7.2.7
			6	Synchronize with GPS	→ Section 7.2.7

7	Screen Capture Setting	—	1	Select Item	—	1	Graphic	→ Section 3.13.4
						2	RADAR Video	→ Section 3.13.4
						3	RADAR Trails	→ Section 3.13.4
						4	Chart	→ Section 3.13.4
			2	Select Card Slot				→ Section 3.13
			3	File Erase				→ Section 3.13.3
			4	AUTO Capture Interval				→ Section 3.13.2
			5	AUTO File Erase				→ Section 3.13.2

9	EBL/Cursor Setting	—	1	EBL1 Bearing Fix	→ Section 4.1.3
			2	EBL2 Bearing Fix	→ Section 4.1.3
			3	Cursor Setting	—	1	EBL/VRM Control CURS	→ Section 3.8.4

1	EBL/VRM Control CURS	→ Section 3.8.4
2	Cursor Length	→ Section 3.8.4
4	Cursor Pattern	→ Section 3.8.4

6	TT Menu	—	1	Association Setting	—	1	Association	→ Section 5.4
						2	Priority	→ Section 5.4
						3	Bearing	→ Section 5.4
						4	Range	→ Section 5.4
						5	Course	→ Section 5.4
						6	Speed	→ Section 5.4
						7	Applicable AIS Target	→ Section 5.4

3	Trial Maneuver	—	1	Trial Function	→ Section 5.7
			2	Course(EBL)	→ Section 5.7
			3	Speed(VRM)	→ Section 5.7
			4	Vector Time	→ Section 5.7
			5	Time to Maneuver	→ Section 5.7
			6	Own Ship's Dynamic Trait	—	1	Reach	→ Section 5.7

1	Reach	→ Section 5.7
2	Turn Radius	→ Section 5.7
3	Acceleration	→ Section 5.7
4	Deceleration	→ Section 5.7

4	Target Number Display	→ Section 5.2.4

9	TT Test Menu	—	1	Test Video	→ Section 5.2.7
			2	TT Simulator	→ Section 5.2.7
			3	Status	→ Section 5.2.7
			4	Gate Display	→ Section 5.2.7

MAIN MENU(RADAR MENU key)
-> Press RADAR MENU again

7	AIS Menu	—	1	Association Setting	—	1	Association	→ Section 5.4
						2	Priority	→ Section 5.4
						3	Bearing	→ Section 5.4
						4	Range	→ Section 5.4
						5	Course	→ Section 5.4
						6	Speed	→ Section 5.4
						7	Applicable AIS Target	→ Section 5.4

3	Trial Maneuver	—	1	Trial Function	→ Section 5.7
			2	Course(EBL)	→ Section 5.7
			3	Speed(VRM)	→ Section 5.7
			4	Vector Time	→ Section 5.7
			5	Time to Maneuver	→ Section 5.7
			6	Own Ship's Dynamic Trait	—	1	Reach	→ Section 5.7
						2	Turn Radius	→ Section 5.7
						3	Acceleration	→ Section 5.7
						4	Deceleration	→ Section 5.7

4	AIS Filter Setting	—	1	Filter Type	→ Section 5.3.7
			2	Make AIS Filter	→ Section 5.3.7
			3	Filter Display	→ Section 5.3.7
			4	ENT	
			6	Filter Mode	→ Section 5.3.7

5 Target Number Display → Section 5.3.6

| 6 | AIS Alarm Setting | — | 1 | Lost   Alarm | → Section 5.3.9 |
| | | | 2 | CPA/TCPA Alarm | → Section 5.3.9 |

| 7 | Message | — | 1 | Addressed Message | → Section 5.3.5 |
| | | | 2 | Broadcast Message | → Section 5.3.5 |

8 Display Lost TGT Data → Section 5.3.5
9 Own Ship's AIS Data → Section 5.3.5

8	Multi Dial Setting	—	1	Vector Time	→ Section 3.3.6
			2	Trails Length	→ Section 3.3.6
			3	TT Display No.	→ Section 3.3.6
			4	C-UP Angle	→ Section 3.3.6
			5	Own Track Color	
			6	Mark/Line Color	→ Section 3.3.6
			7	Manual Tune	→ Section 3.3.6

9	Test Menu	—	1	Self Test	—	1	Memory Test	—	1	SDRAM	→ Section 8.3.1
									2	SRAM	→ Section 8.3.1
									3	FLASH ROM	→ Section 8.3.1
									4	GRAPHIC	→ Section 8.3.1
						2	TXRX Test	→ Section 8.3.1
						3	Line Test	→ Section 8.3.1
						4	Supply Voltage	→ Section 8.3.1

			2	Monitor Test	—	1	Pattern 1	→ Section 8.3.1
						2	Pattern 2	→ Section 8.3.1
						3	Pattern 3	→ Section 8.3.1
						4	Pattern 4	→ Section 8.3.1
						5	Pattern 5	→ Section 8.3.1
						6	Pattern 6	→ Section 8.3.1
						7	Pattern 7	→ Section 8.3.1
						8	Pattern 8	→ Section 8.3.1

			3	Keyboard Test	—	1	Key Test	→ Section 8.3.1
						2	Buzzer Test	→ Section 8.3.1
						3	Light Test	→ Section 8.3.1

4 MON Display
5 System Alarm Log → Section 8.3.1
6 System Information → Section 8.3.1

0 EXIT

Serviceman Menu → Section 7.1.1

1	Adjust Menu					

— 1 Tune Adjustment → Section 7.1.3
2 Bearing Adjustment → Section 7.1.4
3 Range Adjustment → Section 7.1.5
4 TXRX Adjustment

— 1 Antenna Height → Section 7.1.8
2 Tune Peak Adjustment → Section 7.1.3
3 Tune Indicator Adjust → Section 7.1.3
4 MON Adjustment
5 MON Indicator Adjustment
6 Output Pulse → Section 7.2.4

2 Installation Menu

— 1 Installation Information

— 1 Date → Section 7.2.8
2 Name → Section 7.2.8
3 Company → Section 7.2.8

2 Master/Slave → Section 7.2.5
3 Sector Blank

— 1 Sector1 → Section 7.2.2
2 Sector2 → Section 7.2.2
3 Sector3 → Section 7.2.2
4 Make Sector1 → Section 7.2.2
5 Make Sector2 → Section 7.2.2
6 Make Sector3 → Section 7.2.2

4 CCRP Setting → Section 7.1.9
5 COM Port Setting

— 1 Baud Rate

— 1 COMPASS → Section 7.2.1
2 NAV1 → Section 7.2.1
3 NAV2 → Section 7.2.1
4 GPS → Section 7.2.1
5 NMEA → Section 7.2.1

2 RX Port

— 1 GPS → Section 7.2.1
2 DLOG → Section 7.2.1
3 Alarm → Section 7.2.1
4 Depth → Section 7.2.1
5 Temperature → Section 7.2.1
6 Wind → Section 7.2.1
7 Current → Section 7.2.1
8 ROT → Section 7.2.1
9 Next
↓
1 RSA → Section 7.2.1

3 RX Sentence

— 1 GPS(LL/COG/SOG) → Section 7.2.1
2 GPS(WPT/TIME) → Section 7.2.1
3 Depth → Section 7.2.1
4 Wind → Section 7.2.1
5 Current

— 1 Data Set Number → Section 7.2.1
2 Layer A → Section 7.2.1
3 Layer B → Section 7.2.1
4 Layer C → Section 7.2.1

4 TX Port

— 1 TTM(TT) → Section 7.2.1
2 TLL(TT) → Section 7.2.1
3 TTD(TT) → Section 7.2.1
4 TLB(TT) → Section 7.2.1
5 OSD → Section 7.2.1
6 RSD → Section 7.2.1
7 ALR → Section 7.2.1
8 ACK → Section 7.2.1
9 Next
↓
1 TTM(AIS) → Section 7.2.1
2 TLL(AIS) → Section 7.2.1
3 TTD(AIS) → Section 7.2.1
4 TLB → Section 7.2.1
5 Remote Maintenance → Section 7.2.1
6 JRC-ARPA → Section 7.2.1
7 NMEA0183 Output Format → Section 7.2.1
8 NMEA0183 Talker → Section 7.2.1
9 Next
↓
1 NMEA0183 TX Interval → Section 7.2.1
2 APB → Section 7.2.1
3 BOD → Section 7.2.1
4 GGA → Section 7.2.1
5 GLL → Section 7.2.1
6 RMC → Section 7.2.1
7 RMB → Section 7.2.1
8 VTG → Section 7.2.1
9 Next
↓
1 XTE → Section 7.2.1
2 BWC → Section 7.2.1
3 HDT → Section 7.2.1
4 THS → Section 7.2.1

5 Select NAV Equipment → Section 7.2.1

7 Line Monitor

— 1 COMPASS
2 NAV1
3 NAV2/ARPA
4 GPS
5 NMEA
6 TXRX/ISW
7 KEYBOARD1
8 KEYBOARD2

Serviceman Menu → Section 7.1.1

2 Installation Menu	6 Alarm System	2 Relay Output	1 Relay Output Mode → Section 7.2.9
			2 TT CPA/TCPA → Section 7.2.9
			3 AIS CPA/TCPA → Section 7.2.9
			4 New Target → Section 7.2.9
			5 Lost → Section 7.2.9
			6 RADAR Alarm → Section 7.2.9

3 ALR Output	1 System Alarm → Section 7.2.9
	2 TT/AIS Alarm → Section 7.2.9

5 External ACK Setting	1 Critical Alarm	1 Audio → Section 7.2.9
		2 Indication → Section 7.2.9
		3 Acknowledge State → Section 7.2.9
	2 Normal Alarm	1 Audio → Section 7.2.9
		2 Indication → Section 7.2.9
		3 Acknowledge State → Section 7.2.9

7 Inter Switch
- 1 ISW Install
- 2 Mask Setting
  - 1 No.1 Connection / No.1 Master
  - 2 No.2 Connection / No.2 Master
  - 3 No.3 Connection / No.3 Master
  - 4 No.4 Connection / No.4 Master
  - 5 No.5 Connection / No.5 Master
  - 6 No.6 Connection / No.6 Master **Only for ISW Extended Mode**
  - 7 No.7 Connection / No.7 Master
  - 8 No.8 Connection / No.8 Master
- 3 S-ISW TXRX Power Supply

8 Language → Section 7.2.6
9 Next
↓
1 Input BP Count → Section 7.2.5

2 TNI Blank	1 TNI Blank → Section 7.2.3
	2 Make Sector → Section 7.2.3

3 Device Installation	1 Gyro → Section 7.1.6
	2 Compass → Section 7.1.6
	3 GPS Compass → Section 7.1.6
	4 LOG → Section 7.1.6
	5 2AXW → Section 7.1.6
	6 2AXG → Section 7.1.6
	7 GPS → Section 7.1.6

2 Installation Menu — 9 Next
↓

4 Network	1 Network Function → Section 7.2.10
	2 IP Address
	4 Synchronization	1 Day/Night → Section 7.2.10
		2 Keyboard → Section 7.2.10

3 Maintenance Menu
- 1 Safety Switch → Section 7.4.1

2 Area Initial	1 Partial Master Reset	1 Serviceman Menu → Section 7.4.2
		2 Except Serviceman Menu → Section 7.4.2
		3 User Setting → Section 7.4.2
		4 TT Setting → Section 7.4.2
		5 AIS Setting → Section 7.4.2
		6 Day/Night → Section 7.4.2
		7 JRC Card Copy Record → Section 7.4.2
	2 All Master Reset → Section 7.4.2	

3 Internal To Card 1/2 → Section 7.4.3
4 Card 1/2 To Internal → Section 7.4.3

5 TXRX Time	1 Clear TX Time → Section 7.4.4
	2 Clear Motor Time → Section 7.4.4
	3 TXRX to Display Unit → Section 7.4.4
	4 Display Unit to TXRX → Section 7.4.4

6 String Data Update → Section 7.4.5

9 RADAR/TT Initial Setup

1 Signal Processing	1 Echo Noise Level → Section 7.3.1
	2 Setting Mode → Section 7.3.1

2 TT	1 Vector Constant → Section 7.3.2
	2 Video TD Level → Section 7.3.2
	3 Video High Level → Section 7.3.2
	4 Video Low Level
	5 Gate Size → Section 7.3.2
	6 Limit Ring → Section 7.3.2

3 MBS	1 MBS Level → Section 7.3.3
	2 MBS Area → Section 7.3.3